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U. S. DEPARTMENT OF AGRICULTURE

BIOLOGICAL SURVEY—BULLETIN No. 19

C. HART MERRIAM, Chief

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HUNTING LICENSES

THEIR HISTORY, OBJECTS, AND LIMITATIONS

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BY

T. S. PALMER

ASSISTANT IN CHARGE OF GAME PRESERVATION

WASHINGTON
GOVERNMENT PRINTING OFFICE
1904

NOTE.

On page 47 of Bulletin 19 on "Hunting Licenses" reference is made to the case of Cummings *v*. People, involving the constitutionality of the license law of Illinois. On October 24, 1904, the Supreme Court of Illinois rendered a decision in this case upholding the constitutionality of the law and quoting with approval the decisions of the Supreme Court of New Jersey in the case of Allen *v*. Wyckoff, and the United States circuit court of the northern district of Illinois in the case of *In re* Eberle.

The court holds: (1) That the proviso in Section 25 of the Illinois law allowing owners and tenants of farm lands to hunt without obtaining a license, is valid; (2) That lands owned or rented as game preserves are not farm lands, and the owners or tenants are not entitled to hunt without a license; (3) That the clause in Section 32 of the law providing that nothing in the act shall apply to persons hunting by invitation on lands of another "must be held invalid, except in so far as it can be given a limited effect," adding that "the purpose of the legislature doubtless was to authorize the owner of lands to invite another person to do that which he might himself lawfully do, and so construed the proviso can be sustained."

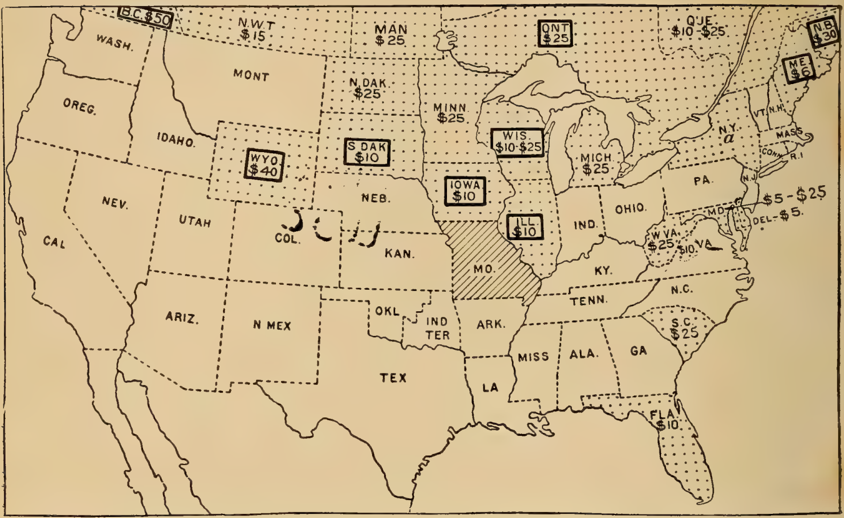
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FIG. 1.—STATES HAVING NONRESIDENT LICENSE LAWS IN 1900.

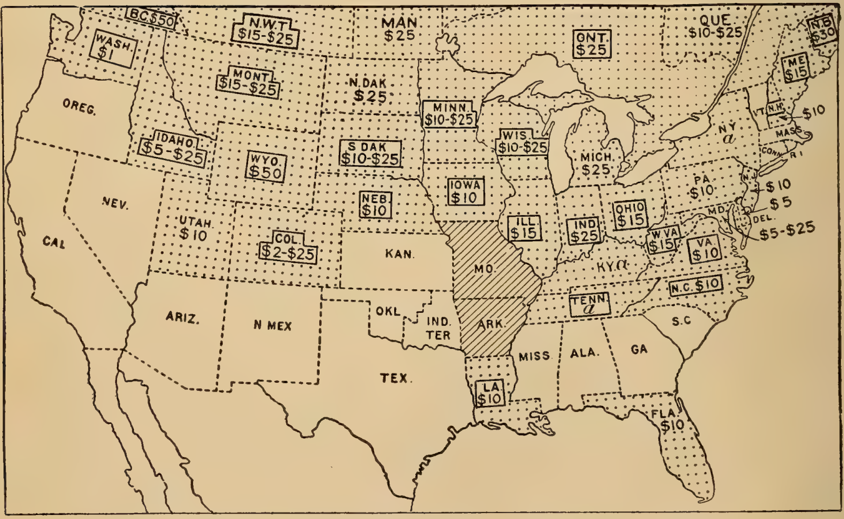
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FIG. 2.—STATES HAVING NONRESIDENT LICENSE LAWS IN 1904.

MAPS SHOWING PROGRESS IN NONRESIDENT LICENSE LEGISLATION.

Inclosed names indicate States which grant special privileges for taking out a limited amount of game. States which are ruled do not permit hunting by nonresidents.

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ASSISTANT IN CHARGE OF GAME PRESERVATION

WASHINGTON
GOVERNMENT PRINTING OFFICE
1904

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Biological Survey,
Washington, D. C., August 20, 1904.

Sir: I have the honor to transmit herewith, as Bulletin No. 19, a report on "Hunting licenses, their history, objects, and limitations," prepared by Dr. T. S. Palmer, assistant in charge of game preservation. The object of this bulletin is to render generally accessible the information collected by the Department on the subject of resident and nonresident licenses. In States which have adopted the license system statistics regarding hunting not previously collected are now available. Thus the figures here presented show that during 1903 the receipts from licenses exceeded $10,000 in each of 9 States, and Illinois and Wisconsin each collected nearly $100,000; the total number of hunters in 10 States which license both residents and nonresidents exceeded 261,000; and the States which attracted most nonresident hunters were Maine, North Carolina, and Wisconsin.

Respectfully,

C. Hart Merriam,
Chief Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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HUNTING LICENSES: THEIR HISTORY, OBJECTS, AND LIMITATIONS.

INTRODUCTION.

Two of the most important problems of practical game protection are how to enforce the laws and how to secure the funds necessary for the purpose. Without funds it is manifestly impossible either to provide or maintain the service required to carry the laws into effect; and if no serious effort is made to secure compliance with the law public interest in game protection flags until it becomes difficult to secure either appropriations or such legislation as will yield revenue for warden service. The most successful method of raising funds thus far devised is a system of licenses which in effect amounts to a direct tax on those who hunt. Several States depend almost entirely on some system of this kind for maintaining their warden service, and others receive from it important additions to their game protection funds. How important such a source of revenue may become can readily be appreciated from the fact that during the past year Maine collected license fees amounting to more than $25,000, Wisconsin $90,000, and Illinois nearly $100,000. In some States this money is derived principally from resident, in others from nonresident, licenses.

The requirements in regard to fees and the method of obtaining licenses differ widely in different sections of the country, and every sportsman who resides in a State which has license laws or who visits States where licenses are required is directly affected by the system. As interest in the subject is widespread, it seems desirable to bring together data showing not only the origin and development of hunting licenses, but also their advantages and disadvantages. Few questions in game protection have attracted more attention in recent years, and none, perhaps, has been more fruitful of discussion or led to more diverse opinions.

HISTORY OF HUNTING LICENSES.

It is commonly supposed that the license feature of game protection, which by many is regarded as unnecessary and unjust, is a recent development; but, although most of the present laws have been enacted during the last ten years, even a hasty review of the subject will show that the system originated at a very early date in the United States,[a] and was in reality an outgrowth of a discriminating attitude toward nonresidents. Hunting licenses were required in some of the colonies, particularly Virginia, more than two hundred years ago, though their object was somewhat different from those of modern times. One of the earliest statutes may be found in "An act for a free trade with Indians," passed in Virginia in April, 1691 (3 Hening's Stat., 69), the object of which was stated as follows:

> And for the future prevention of such mischeifes as have frequently happened at huntings, commonly called fire huntings and other huntings remote from the plantations, *Bee it enacted by the authority aforesaid, and it is hereby enacted*, That no person or persons whatsoever shall hereafter presume to goe an hunting remote from the English plantations without first having obtained the lycense and permission of their Majesties leiutenant governour or commander in cheife for the time being and the councell of state under such restrictions, limitations and conditions as at the time of giveing such permission shall be by them thought fit to be enjoyned and appointed·

DISCRIMINATION AGAINST NONRESIDENTS.

In an act passed on March 27, 1719 (Nevill, 86), nonresidents in New Jersey were prohibited from taking oysters or putting them on board a vessel not wholly owned by a resident. The discrimination against nonresidents in the matter of gathering oysters thus begun nearly two centuries ago has been maintained to the present time by oyster laws similar to the act of 1719 passed in 1820, 1846, and 1899. A similar discrimination may also be found in an act passed in Rhode Island in 1844.

In the second game law enacted in North Carolina (Laws of 1745, Chap. III) all persons not possessed of a settled habitation in the province were required to have a certificate that they had planted and tended 5,000 hills of corn before they were permitted to hunt deer.

Section 4 of this act reads:

> That every person who shall hunt and kill deer in the King's waste within this Province, and who is not possessed of a settled habitation in the same shall be obliged to produce a *certificate* when required of his having planted and tended five thousand corn-hills, at five feet distance each hill, the preceding year, or season, in the county where he shall hunt, under the hands of at least two Justices of the Peace of the said county and the hand of at least one of the churchwardens of the Parish where such person planted and tended such corn, as aforesaid.

This law, which contains the germ of the hunting license, was amended twenty-three years later (Laws of 1768, Chap. XIII) so as to deny the privilege of hunting deer to persons not having a freehold of 100 acres of land in the province, or not having tended 10,000 corn hills during the previous year.

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[a] It is sometimes said that the license idea originated in Canada, but this is not strictly the case.

In 1840 Virginia prohibited nonresidents from hunting wild fowl on beaches or marshes below the head of tide water, and maintained this restriction until 1903. In 1846 New Jersey made nonresidents liable to a fine of $15 and forfeiture of their guns to the informer for trespass with a gun, while residents convicted of the same offense were liable merely to a fine of $5 and costs, or less than one-third the penalty imposed on nonresidents.

In 1854 North Carolina prohibited nonresidents from hunting wild fowl in Currituck County, assigning the following reasons in the preamble of the bill:

> Whereas, large numbers of wild fowl collect during the fall and winter, in the waters of Currituck County, which are a source of great profit to the inhabitants thereof; and whereas, persons from other States, not residents of this State, shoot and kill, decoy and frighten the same, to the great annoyance and detriment of the citizens of our own State: Now Be it enacted, etc. (Laws of 1854, chap. 55.)

Under this act all persons who had not resided in the State for at least twelve months were prohibited from hunting or killing wild fowl in the waters of Currituck County. Recently in North Carolina and Virginia nonresidents hunting wild fowl in certain counties have been prohibited from shooting from sink boxes or boats, in order that this privilege might be reserved for residents alone.

By an act of December 11, 1858, Georgia prohibited nonresidents from hunting or fishing within the limits of the State, in order, it was said, to prevent strangers and others from holding conversation with slaves. Delaware in 1863, following Virginia's example, made it unlawful for nonresidents to kill wild ducks, geese, or other waterfowl on any of the marshes or waters of the State, under a penalty of $50 to $100. Three years later Florida, by act of June 13, 1866, prohibited nonresidents from camping or fire hunting, with or without dogs or guns, in Taylor and Lafayette counties. In 1880 Maryland prohibited nonresidents of the five counties bordering the Patuxent from shooting snipe, rail, and wild fowl on the waters or marshes of the river, and prohibited use of sink boxes in Queen Anne County by nonresidents of the county. Several similar instances of discrimination appeared in subsequent legislation of the State, and culminated in 1890 in a provision prohibiting nonresidents of Parsons Creek, Church Creek, and Neck districts, in Dorchester County, from shooting wild fowl on Little Choptank River.

The West and South have made even more severe discriminations against the nonresident. Missouri, in 1877, prohibited nonresidents from hunting game for market, and two years later prohibited them from hunting at all within the State, a provision which still remains in force. Similar action was taken by Wyoming about 1886, but the absolute prohibition then established was changed in 1895 to a $20 nonresident license. In 1879 Tennessee prohibited nonresidents from hunting deer for profit in certain counties, and in 1889 prohibited all hunting by nonresidents in certain others; but these provisions were replaced by license provisions in the general game law of 1903. Absolute prohibition has recently found favor in one or two other States. It was adopted by Louisiana in 1902,[a] and by Arkansas (except in Mississippi County) in 1903. Louisiana, however, substituted a license fee in 1904; so that at present Missouri and Arkansas are the only States which deny the nonresident the privilege of hunting within their borders.

NONRESIDENT LICENSES.

The history of nonresident license legislation may be conveniently divided into three periods, which overlap one another: (1) Development of the local license, beginning in 1872; (2) development of the market-hunting license, beginning in 1875; and (3) development of the general license, beginning in 1878.

LOCAL LICENSES.

The local license had its rise in the Eastern States. The first law containing a nonresident-license provision was apparently that passed in 1873 in New Jersey, under the title, "An act to incorporate the West Jersey Game Protective Association." (Acts of 1873, chap. 470, p. 553.) This association was incorporated for fifteen years, and section 7 of the act of incorporation provided:

> That if any person or persons nonresidents of this state, shall kill, destroy, hunt, or take any doe, buck, fawn, partridge, moor fowl, grouse, quail, or woodcock, at any time within the counties of Camden, Gloucester, Atlantic, Salem, Cumberland and Cape May in this state without complying with the bylaws of this Game Protective Society then the person or persons so offending shall forfeit and pay the sum of $50 each, for each and every offence * * * provided nothing in this Act shall prevent residents of this state from taking game or fish, subject to the existing laws of this state.

The membership fee was fixed at $5 for the first year and $2 per year thereafter, and nonresidents were required to procure membership certificates before hunting in the six counties above mentioned. These certificates thus became in effect nonresident licenses. In 1878 a somewhat broader general act was passed (Laws of 1878, chap. 184), applicable to other associations in New Jersey. The Delaware Game Protective Association was incorporated by act of legislature in 1879 along much the same lines. Its membership fees were the same as those of the West Jersey Game Protective Association, and nonresidents wishing to hunt in the State were first required to secure certificates of membership. (Laws of 1879, chap. 111.) The same idea was later adopted by the counties on the eastern shore of Virginia, through the passage of a law in 1894 requiring nonresidents of the State to become members of the Eastern Shore Game Protective Association before hunting wild fowl in these counties. The by-laws originally fixed the initiation fee of members at $1 and the annual dues at $1, but in 1901 the license fee required of nonresidents was increased to $10, the rate adopted by the State in its general license law two years later.

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[a] The police jury of Caddo Parish, La., in 1896, however, passed a measure prohibiting hunting by nonresidents in that parish. (Forest and Stream, XLVII, p. 386, Nov. 14, 1896.)

In 1875 Florida adopted a statute (Acts of 1875, chap. 2055, p. 62) making it unlawful for any nonresident to hunt for the purpose of conveying game beyond the limits of the State without first obtaining from the clerk of the county in which he proposed to hunt a license at a cost of $25. In case several persons hunted together, six could be included under the same license on payment of an additional $5 each.

In 1882 Maryland laid the foundation of a county license system by requiring nonresidents to secure licenses to hunt game in Caroline County; and in 1886 established a like requirement in the counties of Anne Arundel, Baltimore, Kent, Prince George, Queen Anne, and Talbot. In 1888 three additional counties—Charles, Dorchester, and Howard—adopted the system; and more recently all the other counties in the State have followed their example; but in 1894 Anne Arundel repealed the license provision and prohibited nonresidents from hunting within the county. (Laws of 1894, chap. 103.)

In 1884 New York passed a special license law (Laws of 1884, chap. 185), which required nonresidents of Richmond County (Staten Island) to secure a $10 license before hunting game in that county. This local license law remained in force until repealed by the general game law of 1892, eight years later, and is apparently the only license of the kind enacted by the State. The general licenses of 1900–1903, reciprocal in character and without fixed fees, merit special consideration, and will be discussed in connection with similar licenses of other States.

In 1892 South Carolina required a $25 license of nonresidents hunting in Beaufort County, and in 1893 extended the law to the rest of the State. In 1899 Illinois adopted a $10 nonresident county license, and West Virginia a $25 county license (both of which have since been changed to State licenses). In 1900 Iowa established a $10 nonresident county license; in 1901 South Dakota and Washington adopted $10 county licenses; and in 1903 Colorado established a county license for nonresidents hunting birds, all of which still remain in effect, except that of Washington, which has been replaced by a hunting license required alike of residents and nonresidents.

This may be said to cover the first period of nonresident-license legislation. The licenses in New Jersey, Delaware, and Virginia were in the nature of fees for membership in private corporations, and those of all the States except Delaware were alike in being local licenses, in most cases good only for the county of issue. With a few exceptions the license fees were comparatively small, usually less than $10. The county license has not met with general favor. It has been adopted by only a few States, and is now in force in less than one-third of the States which have the license system.

MARKET-HUNTING LICENSES.

The effort in some of the Southern States to restrict market hunting and to prevent the export of game from the State for commercial purposes brought about a twofold result—the development of the market-hunting license and the absolute exclusion of nonresidents from hunting privileges. A correspondent of the American Field, who states that he has observed game conditions in Arkansas for twenty-five years, asserts that 90 per cent of the game killed in that State has been killed by market hunters. (Am. Field, LIX, p. 216, Feb. 28, 1903.) In view of this statement, which apparently has strong independent support, it is interesting to notice that Arkansas seems to have been the pioneer in restrictions on market hunters. In the act of March 6, 1875, a tax of $10 was levied on all nonresident trappers, hunters, seiners or netters of fish following their calling in the State. Twenty-two years later, in 1897, the tax was increased to $25. (Acts of 1897, p. 113.) In 1903 two bills were passed by the legislature—one imposing a tax of $300 on all nonresidents hunting in the State, the other absolutely prohibiting hunting by nonresidents except in Mississippi County. The license bill was vetoed; the prohibition bill became a law.

Missouri, in 1877 (Laws of 1877, p. 333), prohibited nonresidents from hunting game for the purpose of selling it or removing it from the State, and in 1879 extended this law so as to prohibit nonresidents from hunting at all within the State.

In 1879 Tennessee enacted legislation prohibiting nonresidents from hunting deer for profit in some counties, and in 1889 in others restricted such hunting to persons hunting on their own lands. These provisions were repealed in 1903 by the adoption of a general game law which provided a market-hunting license of $25 and authorized the State game warden to collect from nonresident sportsmen the same fee which residents of Tennessee would be subject to in their States.

In 1884 South Carolina enacted a law requiring each nonresident engaged in the business of hunting, ducking, fishing, or gathering oysters or terrapin, or in the sale of game in the counties along the sea board—Georgetown, Charleston, Beaufort, Colleton, and Berkeley—to pay a license at the rate of $25 for each nonresident hand employed. (Laws of 1884, p. 734.) These licenses were not required of persons hunting or fishing on their own lands or waters included within them, nor, under an amendment passed in 1892, of persons authorized by landowners to hunt on their property. By act of 1885 a fixed fee of $25 was imposed for the license and also a fee of $25 for each nonresident hand employed, and in 1888 these fees were increased to $500 and $100, respectively, thus raising the cost to a point far above that of any other market-hunting license. Neither of these statutes appears in the code of 1902, and South Carolina is at present without a nonresident license law.

In 1899 Georgia (Acts of 1899, part 1, p. 96) adopted a law authorizing a $25 market-hunting license, but provided that the act was not to be in force in any county until recommended by the grand jury of that county.

Oregon, the only other State to adopt the market-hunting license, passed a law in 1901 making it unlawful for any person not a resident of the State to hunt any game for market purposes without having first obtained a $10 license from the State game and forestry warden. (Laws of 1901, p. 231, sec. 38.)

By an act passed in 1902 Louisiana, following the lead of Missouri and Arkansas, adopted absolute prohibition in the case of nonresident hunters. This act, however, was replaced in 1904 by a $10 nonresident hunting license and a $25 market-hunting license. Thus at the present time the restrictions on market hunting in the South have developed into absolute prohibition in Arkansas and Missouri, into market licenses in Georgia and Louisiana, a market license and modified nonresident license in Tennessee, and the abolition of all licenses in South Carolina. The moderate market license of Oregon remains unchanged.

It is to be observed that the easternmost of these States, South Carolina and Georgia, adopted the county license system, and that there seems to have been a marked inclination toward $25 as the amount of the fee.

GENERAL LICENSES.

The general license seems to have had its origin in Canada. The same feeling of discrimination so conspicuous in the game legislation of the United States existed in Canada, but instead of manifesting itself in absolute prohibition it there took the more liberal form of a system of high licenses for hunting big game. New Brunswick apparently led the way about 1878, and was followed by Quebec in 1882, Nova Scotia in 1884, Ontario in 1888, Newfoundland in 1889, British Columbia and Manitoba in 1890, and the Northwest Territories in 1893. The license sytem thus extended throughout Canada, except Prince Edward Island, Yukon, and the Unorganized Territories. Fees varying from $20 to $25 were charged in some cases for big game only, but in others for hunting game of any kind.

In 1895 general licenses found favor in the Northwestern States, and laws undoubtedly modeled after those of the Canadian Provinces were enacted in several States. This sudden demand for nonresident licenses is interesting from several standpoints, and may have been influenced by two circumstances. On January 9–10, 1895, occurred the second annual meeting of the National Game, Bird and Fish Protective Association at Chicago, at which resolutions were adopted foreshadowing methods of game protection, including shooting licenses, which have since been incorporated into law.[a] About this time a bill was pending in the Illinois legislature practically opening the Chicago markets to unlimited sale of game from other States.[b] Whatever may have been the effect of this convention and of the Illinois game bill, they certainly served to draw attention to the question of discriminating against nonresidents, and although it may have been only a coincidence, nonresident license laws were adopted almost immediately by four States[c]—Wyoming in February, North Dakota in March, Minnesota in April, and Michigan in May. Wisconsin followed in 1897, four other States in 1899, six in 1901, and eight in 1903.

RESIDENT LICENSES.

The history of modern resident hunting licenses properly begins with the system of special licenses developed in some of the counties of Maryland in the early seventies and eighties. Shooting wild fowl from sink boxes, sneak boats, or in some cases from blinds was prohibited except under license, and these licenses were issued only to residents. The first of these special laws was passed in 1872 (Laws of 1872, chap. 54) for the protection of wild fowl on the Susquehanna Flats, at the head of Chesapeake Bay. Section 7 of this act provided:

> No owner, master, hirer, borrower, employee of any owner, or other person, shall use or employ any sink box, or sneak boat of any description whatever, for the purpose of shooting at wild water-fowl therefrom, northward of the line named and described in section 380 [drawn half a mile north of Spesutie Island from Turkey Point, in Cecil County, to the opposite shore of Harford County], without first obtaining a license to so use and employ the same as is hereinafter provided.

The license fee for a sink box was $20, and for a sneak boat $5. The licenses were issued by the clerks of Harford and Cecil counties, and the clerk was allowed 75 cents for issuing each license.

Under section 11 of the same act applicants were required to make oath that they were bona fide residents of the State, and a fine of $50 to $100 was provided for violating any of the license provisions, one-half of which was to be paid to the informer and one-half to the school commissioners of the county. A board of special police was appointed to enforce the provisions of the act, and these officers, commonly known as ducking police, were authorized to seize any sink box or boat used in violation of law. The issue of licenses was thus restricted to residents of the State. Nonresidents were not denied the privilege of hunting waterfowl, but they could not hunt successfully without sink boxes or boats; and, as these could only be used under license, residents who alone were authorized to obtain licenses could control hunting and charge any fees they saw fit for their boxes or boats.

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[a] Am. Field, XLIII, pp. 51–52, Jan. 19, 1895.

[b] House bill 56, commonly known as the 'Blow Bill.' For full text of this measure and the discussion relating to it, see Am. Field, XLIII, pp. 123, 147, 1895.

[c] A game bill containing a $50-nonresident license provision was also introduced in the Nebaska legislature, but failed to pass.—Forest and Stream, XLIV, p. 307, April 20, 1895.

In 1876 the use of sink boxes in the waters of Anne Arundel County with certain exceptions, or on Chesapeake Bay within the limits of the county, was restricted to licensed residents of the county. These licenses were issued at a cost of $30 each. (Laws of 1876, chap. 78.) In 1882 licenses at $2 each (and a clerk's fee of 50 cents) were required for the use of 'booby' or 'bush' blinds on the Magothy, Severn, and South rivers. It is noticeable, however, that the issue of licenses for blinds was not restricted to residents, and that the owner could extend to any person the privilege of shooting from his blind during the open season. (Laws of 1882, chap. 400; 1886, chap. 366.)

In 1878 residents of Cecil County were required to obtain licenses, at a cost of $10, to use sink boxes on the waters of the Elk and Bohemia rivers (Laws of 1878, chap. 292); and in 1880 similar $10 licenses were required in Queen Anne County, and in Cecil and Kent counties for the use of sink boxes on the Sassafras River. (Laws of 1880, chaps. 42 and 370.)

Turning to Canada, mention should be made of a special $5 license which came into use in the Province of Quebec in 1887.[a] This license differed from ordinary resident licenses in being issued only for killing 5 deer and 5 caribou in excess of the limit prescribed by law. The fee still remains the same, but since 1895 the number of deer and caribou has been reduced to 3.

The system of general resident hunting licenses apparently originated in Michigan in 1895[b] as a measure to restrict the slaughter of deer. In his annual report for 1894, Charles S. Hampton, game and fish warden of Michigan, said:

> I am of the opinion that a law licensing all hunters, those of our own State being charged a mere nominal fee, while nonresidents are compelled to pay twenty-five dol-

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[a] Reference may here be made to a somewhat different form of license which was proposed in Colorado in 1885, but not adopted. Licenses were to be issued to immigrants traveling in unsettled parts of the State, allowing them to kill game during the close season for periods not exceeding 30 days at a cost of $5 or $10. (Am. Field, XXIII, p. 121, Feb. 7, 1885.)

[b] It was, however, advocated in Illinois at the same time. Section 7 of the 'Blow Bill,' which failed to pass the Illinois legislature of 1895, contained a provision for a $1 license for all persons except owners or occupants of cultivated farms hunting on their own lands. (Am. Field, XLIII, p. 124, Feb. 9, 1895.)

> lars, is for the present, at least, the best restrictive measure. The decision of the Supreme Court of the United States in McCready vs. Virginia (94 U. S. 391) would seem to set at rest all doubts as to the constitutionality of such a law. Any man carrying a gun and not having a license in his possession, or refusing to show it to any citizen on demand, should be subject to penalty. (Fourth Biennial Report, p. 10.)

Acting on this suggestion, the legislature in 1895 adopted a 50-cent resident license and a $25 nonresident license for hunting deer.

Hawaii, in 1896, before its annexation, passed a law establishing a $5 hunting license for the island of Oahu, and this law still remains in force without change. The high rate is perhaps due in part to the fact that this license is a permit to carry firearms as well as to hunt game, but more especially to the fact that all the game on the island is introduced, and in order to prevent its extermination stricter regulations and higher fees are necessary than would be required under ordinary circumstances.

In 1897 Wisconsin adopted licenses for deer hunting similar to those of Michigan, but made the rate for residents $1. In 1899 Minnesota adopted a 25-cent license for big game; North Dakota, a 75-cent license for all game, and Wyoming, a dollar license for big game; the Wyoming license is required, however, only outside the county in which the hunter resides. Maine also issued licenses at $4 each, allowing residents to kill one deer during the month of September, for food purposes only, in certain counties;[a] but the law met with so much opposition that it was repealed two years later. One dollar resident licenses for big game were adopted in 1901 by South Dakota, and for all game by Nebraska and Washington; in 1903 for all game by Illinois, Colorado, and Idaho, and for waterfowl during the fall season by Indiana; and in 1904 for all game in Somerset County, Md. Thus the resident license system has spread to 13 States and to 3 provinces of Canada.[b] (See Pl. II.)

At first licenses were required only for hunting big game, but there is now a strong tendency to extend them to cover all game, though of States having resident licenses Michigan, Minnesota, South Dakota, Wyoming, New Brunswick, Ontario, and Quebec still have no licenses for small game, while in Indiana none is required except for shooting waterfowl in the fall. The fee, which exhibited considerable diversity at first—50 cents in Michigan, $1 in Wisconsin, 25 cents in Minnesota, 75 cents in North Dakota, $4 in Maine, and $5 in Hawaii—is now uniformly $1, with the exception of the 75-cent fee in North Dakota and Michigan, the $5 fee in Hawaii, the $2 fees in New Brunswick and Ontario, and the $5 fees in Ontario and Quebec. Some diversity still

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[a] In eight of the sixteen counties: Oxford, Franklin, Somerset, Piscataquis, Penobscot, Aroostook, Hancock, and Washington, which comprise more than four-fifths of the area of the State.

[b] Including Quebec, which issues such licenses only for killing big game in excess of the bag limit.

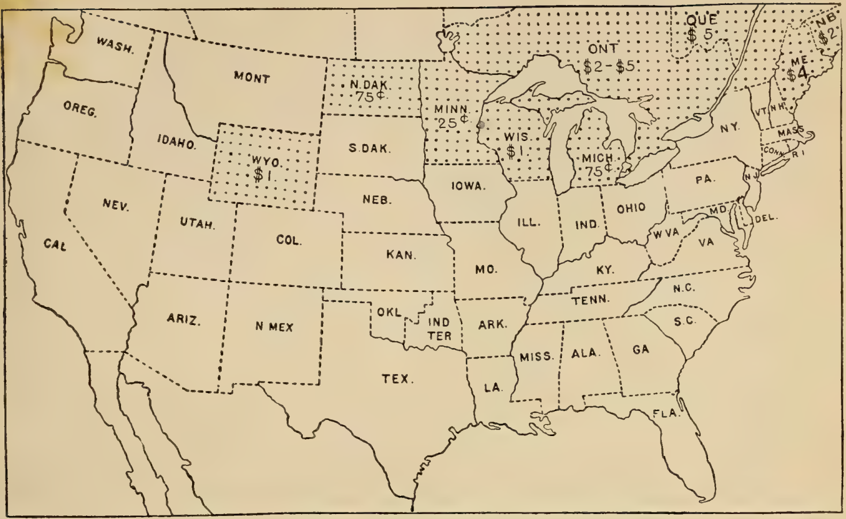

WASH.
MONT
OREG.
IDAHO.
WYO. $1
NEV.
UTAH.
CAL
COL.
ARIZ.
N MEX
N.DAK. 75¢
S.DAK.
NEB.
KAN.
OKL
IND TER
TEX.
MINN. 25¢
IOWA.
MO.
ARK.
LA.
WIS. $1
ILL.
IND.
MICH. 75¢
OHIO
KY.
TENN.
MISS.
ALA.
GA
FLA.
N.C.
S.C.
VA
W VA
PA.
MD.
DEL.
N.J.
N.Y.
VT.
N.H.
MASS.
CONN.
R.I.
ME. $4.
N.B. $2
QUE $5
ONT $2-$5

FIG. 1.—STATES HAVING RESIDENT LICENSE LAWS IN 1900.

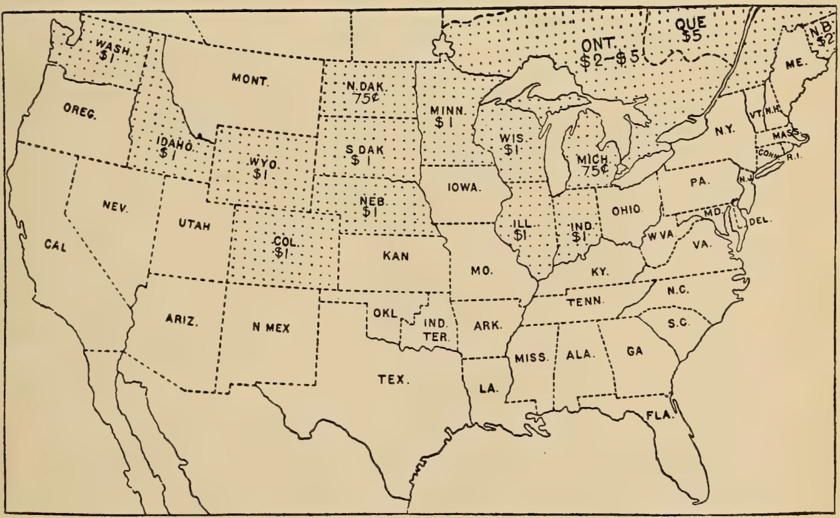

WASH. $1
MONT.
OREG.
IDAHO. $1
WYO. $1
NEV.
UTAH
CAL
COL. $1
ARIZ.
N MEX
N.DAK. 75¢
S.DAK. $1
NEB. $1
KAN
OKL
IND. TER.
TEX.
MINN. $1
IOWA.
MO.
ARK.
LA.
WIS. $1
ILL. $1
IND. $1
MICH. 75¢
OHIO
KY.
TENN.
MISS.
ALA.
GA
FLA.
N.C.
S.C.
VA.
W VA.
PA.
MD.
DEL.
N.J.
N.Y.
VT.
N.H.
MASS.
CONN.
R.I.
ME.
N.B. $2
QUE $5
ONT. $2-$5

FIG. 2.—STATES HAVING RESIDENT LICENSE LAWS IN 1904.

MAPS SHOWING PROGRESS IN RESIDENT LICENSE LEGISLATION.

exists in regard to the territory covered by licenses. In South Dakota and Washington and in Somerset County, Md., they are good only in the county of issue; in Nebraska and Wyoming they are not necessary in the county of residence; and in Illinois and North Dakota they are not required in the case of a citizen hunting on his own land.

SUMMARY OF LICENSE LEGISLATION.

The progress of legislation outlined above may perhaps be brought out more clearly by summarizing under each State and Province the important laws and changes in fees. In the appendix, p. 55, will be found a chronological index of the license laws from 1872 to 1904. The year 1872 is taken as the starting point because it apparently marks the first enactment of a hunting license law in the United States. It should also be explained that the gradation from an ordinary license through one with an exorbitant fee to absolute prohibition is so gradual that it is difficult to draw the line of demarkation. For this reason prohibitive statutes passed since 1872 are included in the summary, and although no systematic attempt has been made to collect earlier ones, those of most interest are referred to on pp. 10–12.

TABLE SHOWING DATES OF ADOPTION OF LICENSE SYSTEM AND PRINCIPAL CHANGES IN FEES.

Arkansas.—1875, $10 market-hunting license; **1897**, fee increased to $25; **1903**, nonresidents prohibited from hunting in the State, except in Mississippi County.

Colorado.—1903, $25 nonresident general license, $1 a day bird license ($2 first day), $1 resident license.

Delaware.—1879, Nonresident license, $5 first year, $2 subsequent years.

Florida.—1875, $25 nonresident county license for hunting game for export; **1899**, $10 nonresident county license for deer, turkeys, or quail; **1903**, $10 nonresident county license for any game. Nonresident license, $1 per day, in La Fayette County.

Georgia.—1899, $25 market-hunting license.

Hawaii.—1896, $5 hunting license in Oahu.

Idaho.—1903, $25 nonresident license for all game, $5 license for birds, $1 resident license.

Illinois.—1899, $10 nonresident county license; **1901**, $10 nonresident State license; **1903**, $15 nonresident license, $1 resident license.

Indiana.—1901, $25 nonresident license, free permits for hunting squirrels and wild fowl October 1–November 10 issued to residents and licensed nonresidents; **1903**, $1 resident permit for hunting wild fowl October 1–November 10 (free to licensed nonresidents).

Iowa.—1900, $10 nonresident county license.

Kentucky.—1902, $25 nonresident license; **1904**, variable fee established.

Louisiana.—1902, Nonresidents prohibited from hunting in the State; **1904**, $10 nonresident license (required also of unnaturalized residents), $25 market-hunting license.

Maine.—1899, $6 nonresident, $4 resident, September deer license; **1901**, law repealed; **1903**, $15 nonresident State license for deer and moose, $5 nonresident license for ducks and sea and shore birds in 5 counties.

Maryland.—1872, $20 sink box and $5 sneak-boat licenses on Susquehanna flats for residents of Cecil and Harford counties.

1876, $30 sink-box license for residents of Anne Arundel County.

1878, $10 sink-box license on Elk and Bohemia rivers for residents of Cecil County; fee for sink-box license on Susquehanna flats reduced to $10 in case of residents of Cecil County.

1880, $10 sink-box license on Sassafras River required of residents of Cecil and Kent counties; nonresidents of Anne Arundel, Calvert, Charles, Prince George, and St. Mary counties prohibited from shooting snipe, rail, and wildfowl on Patuxent River; $10 sink-box license for residents of Queen Anne County (nonresident not allowed to use sink box).

1882, $2 'blind' license on Magothy, Severn, and South rivers in Anne Arundel County; $4.50 nonresident license for rabbits, muskrats, quail or partridges, woodcock, rail, and ducks in Caroline County.

1886, Nonresident county licenses as follows: Anne Arundel and Prince George, $6 (rabbits, partridges, and woodcock); Baltimore, $10 (rabbits and woodcock); Caroline, $19.50 (rabbits, muskrats, quail or partridges, woodcock, rail, and ducks); Kent, $4.50 (all game); Queen Anne, $4.50 (all game); Talbot, $9.50 (all game).

1888, Caroline County license fee reduced to $4.50; nonresident county licenses as follows: Charles, $20 (rabbits, partridges, and woodcock), $25 (wildfowl); Dorchester, $5 (rabbits, partridges, and woodcock); Howard, $7.50 (all game).

1890, Nonresidents prohibited from hunting wildfowl on Little Choptank River in Dorchester County; nonresident county licenses as follows: Somerset, $9.50 (all game); Worcester, $10 (wildfowl).

1892, Nonresidents hunting snipe, rail, and wild fowl on Patuxent River in Anne Arundel and Prince George counties required to have permission of a majority of the residents near the river and to employ licensed boat; $2 pusher's license required on Patuxent River; $20 nonresident license for rabbits, partridges, and woodcock in St. Mary County.

1894, Citizens of Calvert County allowed to hunt snipe, ortolan, and wild fowl on Patuxent River in Anne Arundel and Prince George counties; nonresidents prohibited from hunting in Anne Arundel County or shooting wild fowl in Charles County; sink-box license on Elk and Bohemia rivers in Cecil County abolished and use of boats for hunting wild fowl prohibited. Nonresident county licenses as follows: Baltimore, $10 (gray squirrels, rabbits, partridges, pheasants, and woodcock); Carroll, $10 (squirrels, rabbits, partridges, pheasants, and woodcock); Harford, $10 (rabbits, partridges, pheasants, woodcock, rail, reedbird, and robins); Kent, $15 (rabbits and birds); Prince George, $20 (rabbits, partridges, and woodcock).

1900, $10 sink-box license on Elk and Bohemia rivers reestablished. Nonresident county licenses for hunting any game as follows: Garrett, $25; Somerset, $9.50.

1902, Nonresident county licenses as follows: Calvert, $10 (rabbits, partridges, and woodcock); Cecil, $5.50 (rabbits, quail or partridges, grouse, woodcock, reedbirds, ortolan or rail, and summer ducks); Frederick, $15 (rabbits, partridges, pheasants, wild turkeys, woodcock, and ducks); Montgomery, $15 (squirrels, rabbits, partridges, pheasants, wild turkeys, woodcock, and ducks); Prince George, $20 (rabbits, partridges, pheasants, and woodcock); Washington, $10 (hunting or fishing in county, except on Potomac River, not applicable to taxpayers or residents of Maryland or District of Columbia); Wicomico, $10 (all game).

1904, Nonresident landowners and guests of resident landowners allowed to hunt in Anne Arundel County; special Patuxent River $10 license required of nonresidents hunting birds (members of certain hunting clubs exempt), and $2.50 pusher's license required of residents of State; nonresident license in Baltimore County extended to cover jacksnipe and fee reduced to $5 (photograph of holder required on license). Nonresident county licenses as follows: Allegany, $10 (all game); Somerset, $10 (squirrels, rabbits, muskrats, quail or partridges, doves, woodcock, ducks, and geese); resident county license, Somerset, $1.

Michigan.—**1895**, $25 nonresident license, 50-cent resident license for hunting deer; **1897**, resident license fee increased to 75 cents.

Minnesota.—**1895**, $25 license required of citizens of States having restrictions against nonresident hunters; **1899**, $25 nonresident license and 25-cent resident license for big game; **1903**, $25 nonresident license for big game, $10 nonresident license for small game; resident license extended to cover all game animals and fee increased to $1; license law of 1895 repealed.

Missouri.—**1877**, Nonresidents prohibited from hunting game for sale or export; **1879**, nonresidents prohibited from all hunting in the State.

Montana. **1901**, $25 big-game license and $15 bird license required of nonresidents who pay no taxes in the State.

Nebraska.—**1901**, $10 nonresident license, $1 resident license (not required in county of domicile).

New Hampshire.—**1903**, $10 nonresident deer license.

New Jersey.—**1873**, $5 nonresident license for hunting in Atlantic, Camden, Cape May, Cumberland, Gloucester, or Salem counties; **1896**, license law repealed; **1878**, nonresidents prohibited from hunting in the State except in compliance with the by-laws of the game protection societies; **1902**, $10 nonresident license for any game except waterfowl, snipe, and mud hens.

New York.—**1884**, $10 nonresident license for hunting on Staten Island; **1892**, license law repealed; **1900**, nonresident taking fish or game on fresh waters bounding State subject to same restrictions as citizen of New York in State of nonresident; **1902**, nonresidents subject to license restrictions imposed by their own States on nonresidents; **1903**, license fee fixed by commissioner in case of nonresidents from States without license laws.

North Carolina.—**1883**, Nonresidents prohibited from shooting wild fowl from floating blinds or batteries in Currituck and Dare counties; **1895**, $25 nonresident license for shooting on Dare County ducking grounds; **1897**, nonresidents prohibited from hunting birds in Camden County; **1899**, $25 nonresident license for clubhouses in Dare County; **1903**, $10 nonresident license ($20 in Cabarrus County).

North Dakota.—**1895**, $25 nonresident license and 50 cents resident license (landowners hunting on their own property exempt, and nonresidents cultivating quarter section of land need only resident license); **1897**, resident license fee increased to 75 cents, and nonresident owners of cultivated lands required to secure resident licenses; **1899**, residents under 16 exempt.

Ohio.—**1902**, $25 nonresident license; **1904**, fee reduced to $15.

Oregon.—**1901**, $10 nonresident market-hunting license.

Pennsylvania.—**1901**, $10 nonresident license (landowners exempt); **1903**, same license required of unnaturalized foreign-born residents.

South Carolina.—**1884**, $25 license for each nonresident hand employed by nonresidents hunting ducks in Beaufort, Berkeley, Charleston, Colleton, and Georgetown counties; **1885**, license modified to add $25 fee for pursuit of the business; **1888**, license fee increased to $500 and $100 additional fee for each nonresident employed by licensee; **1892**, $25 nonresident license for hunting in Beaufort County; market-hunting license extended to Horry County; **1893**, $25 nonresident county license extended to rest of State (persons hunting on their own land exempt); **1902**, repealed by omission from code.

South Dakota.—**1899**, $10 nonresident county license; **1901**, $25 nonresident and $1 resident county licenses, for big game.

Tennessee.—**1877**, Nonresidents of Lake and Obion counties prohibited from killing wild fowl for market on Reelfoot Lake; **1879**, market hunting prohibited in 13 counties; **1889**, nonresidents of the county prohibited from market hunting in certain counties and from all hunting in others; nonresidents of the State prohibited from killing wild fowl on Reelfoot Lake; **1897**, nonresidents of Grundy and Van Buren counties prohibited from killing deer, quail, and wild turkey in these counties; **1901**, similar law for Bledsoe County; **1903**, $25 market-hunting license and nonresident license with same fee as resident of Tennessee is required to pay in State of applicant.

Utah.—1903, $10 nonresident gun license.

Virginia.—1886, Nonresidents prohibited from killing wild fowl from skiffs or sink boxes in Fairfax, Henrico, King George, Prince William, and Stafford counties; **1891**, nonresidents prohibited from killing wild fowl on lands below head of tide water, except in Accomac and Northampton counties; **1894**, nonresidents, except members of the Eastern Shore Game Protective Association, prohibited from killing wild fowl in Accomac and Northampton counties; **1900**, $10 nonresident county license for deer and upland game birds in Alleghany, Augusta, Bath, Botetourt, Highland, and Rockbridge counties; **1903**, $10 nonresident license (children and guests of resident landowners exempt under certain conditions).

Washington.—1901, $10 nonresident county license and $1 resident county license (persons under 16 exempt, and privileges of resident license extended to citizens of Idaho and Oregon); **1903**, uniform $1 county license for residents and nonresidents.

West Virginia.—1899, $25 nonresident county license; **1903**, $15 nonresident State license.

Wisconsin.—1897, $30 nonresident deer license, $1 resident deer license; **1899**, nonresident deer license fee reduced to $25, $10 nonresident license for other game, $1 resident license for all game.

Wyoming.—1886, Nonresidents prohibited from hunting game animals; **1895**, $20 nonresident county license for big game; **1899**, fee increased to $40; $1 resident gun license for hunting big game outside county of residence; **1903**, nonresident license fee increased to $50.

British Columbia.—1890, $50 nonresident license for big game (members of army, navy, and Canadian militia exempt).

Manitoba.—1890, $25 nonresident license.

New Brunswick.—1878, $20 nonresident license (fee $5 for officer of army or navy); **1897**, $20 nonresident, $2 resident licenses for moose or caribou, nonresidents required to give $100 bond, with two resident sureties; **1900**, fee for nonresident license for hunting moose and caribou increased to $30; $30 nonresident license for hunting in Westmoreland County; **1903**, 25 cent resident license for hunting in Westmoreland County.

Newfoundland.—1889, $100 nonresident caribou license (officers of British war ships stationed on coast for fisheries' protection exempt); **1899**, caribou license fees reduced as follows: $40 for 2 stags and 1 doe, $50 for 3 stags and 1 doe, $80 for 5 stags and 2 does; **1902**, $100 nonresident license permitting killing of 3 stag caribou; **1903**, fee reduced to $50.

Northwest Territories.—1893, $5 nonresident license for big game or birds (five-day licenses free to guests of residents); **1898**, nonresident license for all protected game increased to $15, guest license abolished; **1899**, $1 five-day license for hunting by nonresident guest of resident, $15 nonresident license for calendar year (all big game and birds); **1903**, $25 nonresident license for all game and $15 nonresident license for birds.

Nova Scotia.—1884, $30 nonresident moose license and $10 nonresident bird license ($5 fee for officers of army and navy, members of Game Protection Society exempt); **1896**, $30 nonresident license for big game, $10 nonresident license for birds, hares, and rabbits ($5 fee restricted to officers stationed at Halifax, employees of Provincial or Canadian government, persons formerly domiciled in Nova Scotia, and nonresidents paying $20 real-estate tax exempt); **1902**, big game license modified to cover all game and fee increased to $40; **1904**, special $30 nonresident license required for moose.

Ontario.—**1888**, $10 nonresident license for deer (shareholders of incorporated company hunting on lands of company exempt); **1892**, $25 nonresident license for big game or birds; **1896**, $2 resident license for deer; **1900**, $5 resident license for moose, reindeer, or caribou.

Quebec.—**1882**, $20 nonresident license; **1884**, residents of Ontario exempted and lieutenant-governor in council empowered to grant hunting permits at lower rate or gratuitously; **1887**, $5 license permitting residents to kill 5 caribou and 5 deer above regular limit, $10 fee to members of incorporated hunting and fishing clubs; **1895**, number of extra caribou and deer allowed under $5 license reduced to 3; nonresident licenses as follows: $30, all game; $25, big game and fur-bearing animals; $20, game birds; $10, game birds in the Gulf of St. Lawrence; half rates for members of incorporated fish and game clubs; **1897**, nonresident license fees fixed by lieutenant-governor in council, lower rates for members of incorporated fish and game clubs leasing hunting reserves.

DETAILS OF LICENSES.

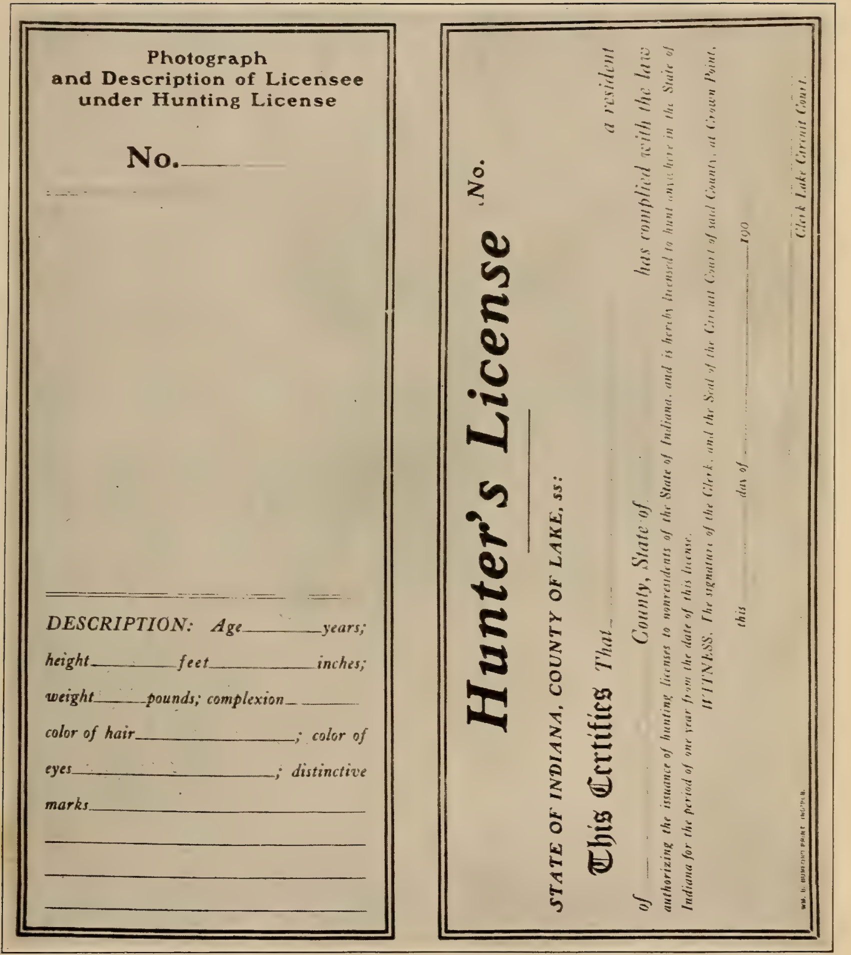
The various matters connected with the issue of licenses may be conveniently considered under four heads—forms of licenses, fees, details of issue, and exemptions or privileges.

FORMS OF LICENSES.

It is interesting to note the development in the form of the license. Some States, like Delaware, Florida, and North Dakota, still issue a simple license to hunt or kill game. Others, like New Hampshire, New Jersey, and Pennsylvania, have adopted forms which, to prevent transfer, contain a description of the holder. Illinois in 1901 went a step further and required that the owner's photograph appear on the license. After two years' trial this feature was discontinued, but simultaneously with its abandonment by Illinois it was adopted by Indiana (see Pl. III), and in 1904 by Baltimore County, Md. New Brunswick in 1897 required the licensee to give a $100 bond with two resident sureties.

The most complete form of license is the coupon license, (see Pl. VI), first devised by Michigan in 1897, and since adopted by Colorado. Maine, Minnesota, Montana, Wisconsin and Wyoming. It is designed to allow shipment of a certain specified quantity of fish or game by the holder, and at the same time to maintain a check on such shipments. Each license is provided with a number of coupons corresponding to the number of deer or other game which may be lawfully shipped, and one of these coupons must be attached to each head, carcass, or skin, before shipment. Several improvements have been made developing slightly differing forms, but the best is probably that in use in Minnesota. This license contains an abstract of the law, is mounted on cloth and is arranged to fold conveniently so that it can be carried in the pocket without injury, and each coupon is provided with a metal eyelet to facilitate attachment to the game (see Pl. IV).

A form of nonresident license reciprocal in nature has been adopted in a few States. It originated in Minnesota in 1895, and was adopted with some modifications by New York in 1900–1902, Tennessee in 1903, and Kentucky in 1904, but has now been abandoned by Minnesota and further modified by New York. As originally enacted in Minnesota it was a simple $25 nonresident license but applicable only to "citizens of such States as have restrictive laws against nonresident hunters." New York changed the scheme so as to make the law general, but provided that the fee should be the same as that charged nonresidents in the applicant's State. In 1903 it modified the law so as to empower the forest, fish, and game commissioner to fix a fee for licensees from



Photograph and Description of Licensee under Hunting License

No.________

*DESCRIPTION: Age*________*years;*

*height*________*feet*________*inches;*

*weight*______*pounds; complexion*________

*color of hair*____________*; color of*

*eyes*____________*; distinctive*

*marks*____________

Hunter's License *No.*

STATE OF INDIANA, COUNTY OF LAKE, ss:

This Certifies *That* ________ *a resident*

of ________ *County, State of* ________ *has complied with the law*

authorizing the issuance of hunting licenses to nonresidents of the State of Indiana, and is hereby licensed to hunt anywhere in the State of Indiana for the period of one year from the date of this license.

WITNESS. The signature of the Clerk, and the Seal of the Circuit Court of said County, at Crown Point,

this ________ *day of* ________ *190*

____

Clerk Lake Circuit Court.

THE PHOTOGRAPH LICENSE OF INDIANA, 1903.

Size 7¾ by 9¼ inches, printed on buff cardboard, and folded for mailing or carrying in the pocket.

States which have no fees for nonresident licenses. Tennessee and Kentucky adopted the general plan of the New York law of 1902.

The reciprocal license is experimental and has been adopted only in States which have not yet established a regular license, or where the usual form of license has proved unsuccessful. At first sight it seems to have much in its favor, since it taxes only hunters from States where the nonresident license system is in force, but the requirement is very difficult of enforcement and its inequalities are likely to arouse resentment. The Minnesota law, which was one of the first in the country providing for general licenses, proved a failure, and thus far the New York law has been a dead letter. Kentucky apparently adopted the plan chiefly because its own first high-license law was not a success, while the Tennessee law was proving more effective. Tennessee is, in fact, the only State in which this method seems to have accomplished its purpose. If each State had a single fixed rate it might be possible to carry out the idea with some degree of success, but when the applicant is a resident of a State where separate rates are in force for large and small game, as in Idaho, Minnesota, Colorado, Montana, North Dakota, South Dakota, and Wisconsin, it is not easy to do so; and when he resides in a State like Maryland, where the license fee varies with each county, it is difficult to determine what rate he should be charged. The question is still further complicated by exemptions allowed landowners, as in North Dakota, or guests, as in Maryland and Virginia. Furthermore, it is not clear what is expected of a nonresident from New York hunting in Kentucky or Tennessee, or vice versa. Apart from these administrative difficulties the law is likely to create friction in a rigid enforcement of its provisions. Two residents from Maryland, for example, hunting in the Adirondacks might think it unfair that one should be charged $5 and the other $25 because the first happened to be a resident of Dorchester County and the second of Garrett County; and it would be equally irritating to two residents of Maryland hunting on the same estate in Tennessee by invitation of the owner if one, being from Washington County, should have the privilege without charge, while the other, being from Garrett County, should have to pay a fee of $25, because Washington County exempts from the license laws nonresidents hunting by invitation on their host's land, while Garrett County makes no such exemption.

FEES.

The fees charged for nonresident licenses have varied from $1 to $500, those for resident licenses from 25 cents to $5. One dollar is the present rate charged residents and nonresidents alike in Washington[a] (see Pl. VII), and $500—probably the highest game license fee in the world—that formerly required for a nonresident market-hunting license in South Carolina. Other high licenses are those for caribou in Newfoundland, $100, in 1889 and 1902, but now reduced to $50, and the present $50 license fees for big game in British Columbia and Wyoming (see Pl. VII). Apparently the rate is often fixed without regard to the kind of game which the State has to offer, and is influenced more or less by the fees prevailing in neighboring States. Thus Indiana and Ohio, which have no big game, require nonresidents to pay $25, the same rate which is required in Idaho and Montana, where deer, elk, goats, and other big game may be obtained. Maine, which has excellent big game hunting, exacts but $15, and Utah but $10, while South Carolina, which offers little beside game birds, until recently required $25, and made the license good only in the county in which it was issued. Maine and New Brunswick both have moose and deer and offer much the same opportunity for hunting, but the fee in New Brunswick is $30, or exactly twice that in Maine. The tendency at the present time seems to be in the direction of a license of $25 for big game and $10 for game birds, both good throughout the State. The only States in which county licenses still prevail are Florida, Georgia, Iowa, Maryland, South Dakota, and Washington. In Colorado they are also issued to nonresidents hunting birds.

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[a] Although Washington, in 1903, actually established the first low uniform fee for residents and nonresidents in the United States, the same principle was advocated eight years earlier in Illinois in a bill which failed to pass the legislature in 1895. (See footnote, p. 17).

DETAILS OF ISSUE.

The following table shows the States that require nonresident licenses, the amounts of the fees, the officials from whom licenses are obtainable, the disposition of the fees, and the limitations as to the amount of game that may be exported.

Details of Nonresident Licenses for hunting game.[a]

State.	Fee.	By whom issued.	Disposition of fee.	Export limit; remarks.
Arkansas				Nonresidents not permitted to hunt.
Colorado	$25 (all game).	Commissioner of game.	Game protection.	Export allowed under permit.
	$1 per day (birds).	....do	....do	County license for birds, $2 first day.
Delaware	$5 first year, $2 thereafter.	Delaware Game Protective Association.	....do	Export of rabbits, quail, partridges, woodcock, robins, Wilson snipe prohibited.
Florida[b]	$10	Clerk county circuit court.	....do	Export of deer, quail, wild turkeys prohibited. County license.
Georgia	$25	County ordinary	County treasury	County market hunting license. Export of quail prohibited.

[a] For exemptions see pp. 30–32.

[b] License not applicable to counties having special game laws.

Details of Nonresident Licenses for hunting game—Continued.

State.	Fee.	By whom issued.	Disposition of fee.	Export limit; remarks.
Hawaii (Oahu)	$5	Treasurer		
Idaho	$25 (all game)	State warden or deputy, justice of the peace.	Game protection	2 deer, 1 ibex, 1 goat, 1 sheep, 1 elk per season.
	$5 (birds)	do	do	Export of birds prohibited.
Illinois	$15	County clerk	do	50 birds.
Indiana	$25	Clerk of circuit court of county.	do	24 birds.
Iowa	$10	County auditor	do	25 of all game. County license.
Kentucky	(*a*)	County clerk	State treasury	Export prohibited.
Louisiana	$10	Sheriff of parish	Game protection	1 deer, 12 birds.
Maine (moose and deer).	$15	Commissioners of inland fisheries and game.	do	1 moose, 2 deer per season.
	$5 (ducks and shore birds).[b]	do	do	
Maryland	$4.50–$25	Clerk of circuit court.	Schools, roads, or general county expenses.	Separate county laws, with varying export provisions.
Michigan	$25 (deer)	County clerk	Game protection	Export prohibited.
Minnesota	$25 (big game); $10 (birds).	Board of game and fish commissioners.	do	2 deer, 1 moose, 1 caribou, 25 birds.
Missouri				Nonresidents not permitted to hunt.
Montana	$25 (big game); $15 (birds).	State game and fish warden.	Game protection	6 deer, 2 elk, 6 goats per season; 20 grouse, prairie chickens, fool hens, pheasants, sage hens, partridges, doves per day.
Nebraska	$10	Game and fish commissioner.	Schools	50 birds.
New Hampshire	$10 (deer)	Fish and game commissioner.	Game protection	2 deer. Export of birds prohibited.
New Jersey	$10	County clerk	do	Export of upland game, except wild turkeys, prohibited. License not required for waterfowl, snipe, or mud hens.
New York	(*a*)	Forest, fish, and game commissioner.	State treasury	Export prohibited.
North Carolina	$10	Clerk superior court.	Game protection	50 quail.
North Dakota	$25	County auditor	(*c*)	Export prohibited.
Ohio	$15	County clerk	Game protection	50 of all game.

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[a] Rate of State of nonresident.

[b] In Knox, Lincoln, Sagadahoc, and Waldo counties, and the townships of Brunswick, Freeport, and Harpswell in Cumberland County.

[c] 20 per cent State treasury, 70 per cent game protection, 10 per cent county auditor.

Details of Nonresident Licenses for hunting game—Continued.

State.	Fee.	By whom issued.	Disposition of fee.	Export limit; remarks.
Oregon	$10	Game and forestry warden.	State treasury	Market hunting. Export prohibited, except that Washington hunter may take one day's bag.
Pennsylvania	$10	County treasurer	50 per cent county treasury; 50 per cent game protection.	Export prohibited.
South Dakota	$25 (big game);	do	Game protection	3 deer, 1 elk, 1 buffalo, 1 sheep, 15 birds. County license. Licensee must be in charge of qualified guide.
	$10 (birds)	do	do	State license.
Tennessee	(*a*)	State game warden	State treasury (?)	
Utah	$10	County fish and game warden.	State treasury	Export prohibited.
Virginia	$10	County clerk	Game protection	1 deer, 50 quail, 10 pheasants or grouse, 3 wild turkeys, 30 water fowl, 25 each or 100 in all of plover, snipe, sandpipers, willets, tatlers, and curlews.
Washington	$1	County auditor	Game protection	Export prohibited, except that Oregon hunter may take 1 day's bag. County license.
West Virginia	$15	State game warden	State treasury	Export prohibited of deer, quail, ruffed grouse, pheasants, and wild turkeys.
Wisconsin	$25 (all game); $10 (small game).	Secretary of state	Game protection	2 deer, 2 rabbits, 2 squirrels, 50 birds.
Wyoming	$50	Justice of the peace	do	2 deer, 2 elk, 2 antelope, 1 sheep, 1 goat. Licensee must employ guide.
British Columbia	$50	Any Government agent.		10 deer, 2 elk, 2 moose, 5 caribou, 5 goats, 5 sheep, under license. No birds.
Manitoba	$25	Minister of agriculture and immigration.		Export prohibited.
New Brunswick	$30 (moose and caribou).	Surveyor-general, chief game commissioner, any game warden.	Game protection	1 moose, 1 caribou.
	$30 (deer and game birds).	do		2 deer. License required only in Westmoreland County.

[a] Rate of State of nonresidents.

Details of Nonresident Licenses for hunting game—Continued.

State.	Fee.	By whom issued.	Disposition of fee.	Export limit; remarks.
Newfoundland	$50 (caribou).	Minister of marine and fisheries, stipendiary magistrate, justice of the peace.	Game protection	3 caribou, under license and permit.
Northwest Territories.	$25 (all game); $15 (birds).	Game guardian		Trophies of 3 deer, 3 elk, 3 moose, 3 caribou (2 of each in Southeastern Assiniboia).
Nova Scotia	$40 (all game); $30 (moose); $10 (birds, hares, and rabbits).	Provincial secretary, county clerk, chief game warden.	Game protection	2 moose.
Ontario	$25	Chief warden	do	2 deer, 1 moose, 1 caribou, 100 ducks.
Quebec	$25 (general license); $20 (animals); $10 (birds); $1.50 a day (birds).	Commissioner of lands, forests, and fisheries.		Separate license required for shooting game birds in Gulf of St. Lawrence.

The corresponding details for resident licenses are shown in the following table:

Details of Resident Licenses for hunting game.

State.	Fee.	By whom issued.	Disposition of fees.	Remarks.
Colorado	$1.00	Commissioner or county clerk.	25 cents to clerk, 25 cents county fund, 50 cents game fund.	Expires Dec. 31.
Hawaii (Oahu)	5.00	Treasurer		Good for one year from date of issue.
Idaho	1.00	State warden, justice of peace.	Game protection	Expires Feb. 15.
Illinois	1.00	City, village, or county clerk.	do	Expires June 1; not required of one hunting on land which he owns or occupies.
Indiana	1.00	Game commissioner	do	Required for waterfowl, Oct. 1 to Nov. 10.
Maryland	1.00	County clerk	Schools.	Somerset County.
Michigan	.75	do	25 cents to clerk, 25 cents to State warden service, 25 cents to county warden service.	Deer only.
Minnesota	$1.00	County auditor	Game protection	Big game only; expires Dec. 31.

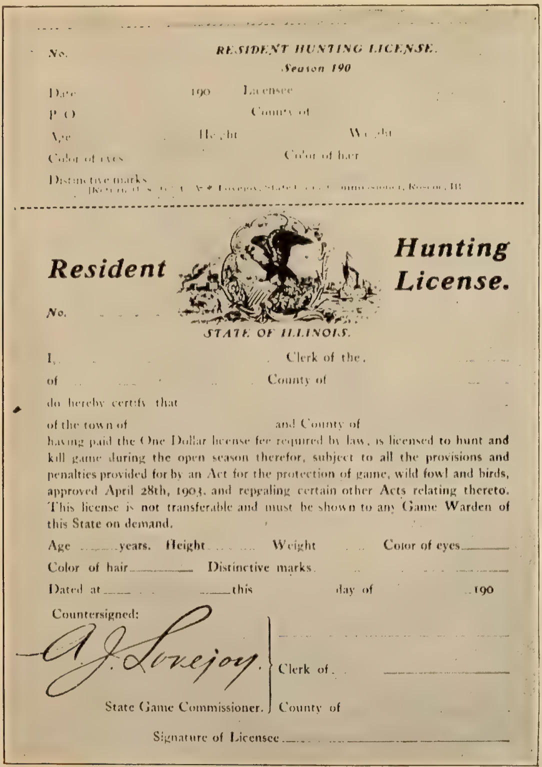
Details of Resident Licenses for hunting game—Continued.

State.	Fee.	By whom issued.	Disposition of fees.	Remarks.
Nebraska	1.00	Game commissioner	Schools	Necessary outside county of residence; expires Dec. 31.
North Dakota	.75	County auditor	20 per cent to general fund, 10 per cent to county auditor, 70 per cent to wardens.	Not required by citizen hunting on his own land; expires Dec. 31.
South Dakota	1.00	County treasurer	Game protection	Big game only; county license; licensee must be in charge of qualified guide.
Washington	1.00	County auditor	do	County license.
Wisconsin	1.00	County clerk	Warden fund	
Wyoming	1.00	Justice of the peace.	Payment wardens and attorneys.	Big game; not required in county of residence; expires Dec. 31.
New Brunswick	2.00	Chief game commissioner, any game warden.	Game protection	Moose and caribou.
	.25			Deer and game birds in Westmoreland County.
Ontario	5.00	Chief warden	do	Moose and caribou.
	2.00	do	do	Deer.
Quebec	5.00	Commissioner of lands, forests, and fisheries.		3 deer and 3 caribou in excess of bag limit.

EXEMPTIONS.

One of the chief objections to nonresident license laws, and one of the features which usually causes the greatest hardship, is that requiring nonresidents who own land within the State to secure licenses. To meet this difficulty several States have made special exceptions in their laws. These exceptions merit mention with some detail to show the various solutions of the question which have been proposed.

Montana exempts taxpayers, and New Hampshire those who own real estate within the State to the value of $500. New Jersey excepts nonresident owners of freehold estates and their sons, and North Dakota allows nonresidents owning or cultivating quarter sections of land to take out resident licenses in the county where the land is situated. Pennsylvania, in the act of 1901, made an exception in favor of owners of real estate, but repealed the provision in 1903. South Carolina (law no longer in force) and Tennessee and West Virginia make exceptions in favor of landowners hunting on their own property. Tennessee makes a further exemption in the case of nonresidents who pay $100 in taxes in the State, and Virginia allows nonresident children and guests of resident landowners to hunt on the lands of their parents or hosts if the guest is accompanied by his host or a member of his family and the host receives no compensation, directly or indirectly.



No. *RESIDENT HUNTING LICENSE.*
Season 190

Date 190 Licensee
P. O. County of
Age Height Weight
Color of eyes Color of hair
Distinctive marks

Resident Hunting License.

No.

STATE OF ILLINOIS.

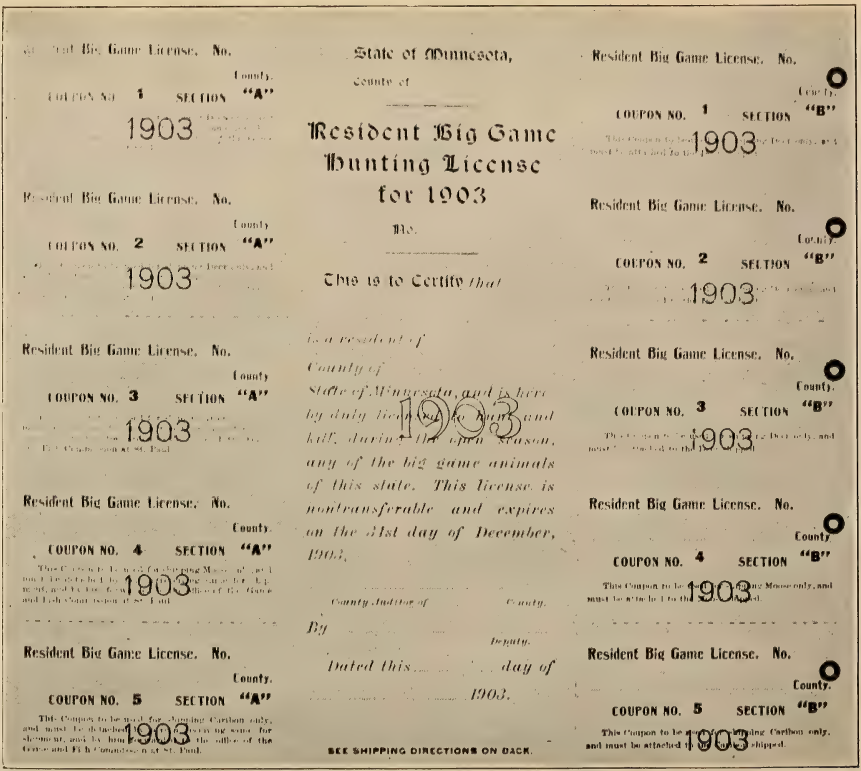
I, Clerk of the
of County of
do hereby certify that
of the town of and County of
having paid the One Dollar license fee required by law, is licensed to hunt and kill game during the open season therefor, subject to all the provisions and penalties provided for by an Act for the protection of game, wild fowl and birds, approved April 28th, 1903, and repealing certain other Acts relating thereto. This license is not transferable and must be shown to any Game Warden of this State on demand.

Age ......years. Height ...... Weight ...... Color of eyes______
Color of hair______ Distinctive marks______
Dated at______ ______this ______day of ______190

Countersigned:
A. J. Lovejoy
State Game Commissioner.

Clerk of______
County of______

Signature of Licensee______



Resident Big Game License. No.
County.
COUPON NO. 1 SECTION "A"
1903

Resident Big Game License. No.
County.
COUPON NO. 2 SECTION "A"
1903

Resident Big Game License. No.
County.
COUPON NO. 3 SECTION "A"
1903

Resident Big Game License. No.
County.
COUPON NO. 4 SECTION "A"
1903

Resident Big Game License. No.
County.
COUPON NO. 5 SECTION "A"
1903

State of Minnesota,
County of

Resident Big Game Hunting License for 1903

No.

This is to Certify *that*

is a resident of
County of
State of Minnesota, and is hereby duly licensed to hunt and kill, during the open season, any of the big game animals of this state. This license is nontransferable and expires on the 31st day of December, 1903.

County Auditor of *County.*
By *Deputy.*
Dated this *day of* *1903.*

SEE SHIPPING DIRECTIONS ON BACK.

Resident Big Game License. No.
County.
COUPON NO. 1 SECTION "B"
1903

Resident Big Game License. No.
County.
COUPON NO. 2 SECTION "B"
1903

Resident Big Game License. No.
County.
COUPON NO. 3 SECTION "B"
1903

Resident Big Game License. No.
County.
COUPON NO. 4 SECTION "B"
1903

Resident Big Game License. No.
County.
COUPON NO. 5 SECTION "B"
1903

RESIDENT LICENSES, ILLINOIS AND MINNESOTA.

Illinois license $5\frac{1}{4}$ by $7\frac{3}{8}$ inches, printed on light-blue glazed paper and mounted on linen.
Minnesota license 8 by 9 inches, printed on buff cardboard with shipping directions on back; coupons with metal eyelets.

In Maryland special exceptions regarding landowners prevail in some of the counties. Dorchester County excepts nonresident landowners or their relatives, and relatives or connections by marriage of residents; Kent exempts nonresidents owning lands, and tenants in lawful possession of real estate; and under an act passed in 1904 regulating hunting on the Patuxent River those persons are considered bona fide residents of the State that belong to any incorporated hunting club whose membership does not exceed 30, and which owns or leases real estate within a mile of the river, and has improved its property by a club-house.

Other exceptions are based on other considerations. Idaho requires no license from women, and prohibits children under 12 from obtaining licenses. Wyoming excepts bona fide minors; North Dakota, children under 16 if they have the written consent of their parents or guardians to hunt; and Washington, in the law of 1901, excepted boys under 16, a provision which caused the law to be declared unconstitutional by the circuit court of Spokane County. Washington County, Md., makes the provision of its license law inapplicable to hunting along the Potomac River, and exempts residents of the District of Columbia as well as Maryland.

Illinois inserted a provision in its law permitting nonresidents to hunt without a license on the lands of another by invitation. This proviso was declared void by the attorney-general of the State, but merely because of ambiguity, owing to its location in the law. A similar exemption of guests of residents or landowners is in force in many counties of Maryland, and visiting sportsmen often secure invitations instead of licenses.[a] Kent County, Md., issues licenses at one-third the regular rate to nonresidents invited by landowners.

In some of the Canadian provinces exceptions are made in favor of army and navy officers. For example, British Columbia does not require licenses of officers of the army and navy or of the Canadian militia in actual service, Newfoundland allows officers of British war vessels stationed on the coast for the protection of fisheries to employ unlicensed guides and to hunt caribou without license, and Nova Scotia excepts officers stationed at Halifax, provided they are members of the Game and Inland Fishery Protection Society.

Some of these exemptions have practically nullified the laws or made them very difficult of enforcement. Thus it was found in Pennsylvania that nonresidents would purchase a few acres of wild land to secure immunity from the license law, and the secretary of the game commission of that State advised in his report for 1902 (p. 5) that the nonresident hunter should be required to pay the license fee, as in adjoining States, regardless of the ownership of property.

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[a] Guests of landowners require no licenses in any of the counties of the State except Allegany, Caroline, Dorchester, Garrett, Kent, Somerset, Talbot, and Worcester.

The North Dakota exemption in favor of nonresidents owning or cultivating a quarter section of land has been made use of to evade the payment of the license fee. The game warden of the second district of this State says:

> I believe that all nonresident hunters should be required to pay the full fee of $25, and see no good reason why an exception should be made in favor of those who are the owners of land in the state. A fraudulent use, I think, is frequently made of this latter clause, as it is an easy matter to temporarily transfer the title of land in order to evade the payment of $25, for a permit. It would only be fair in case all nonresidents are charged the $25 fee if they were granted some privileges in regard to shipping game out of the state.

Of the Wyoming provision exempting from the payment of the resident license fee citizens hunting in their own counties, the State game warden says in his report for 1903 (pp. 3–4):

> The law as it stands is difficult to enforce, produces but little revenue and is useless as a means of identification.
>
> With a nonresident gun license of fifty dollars, the temptation is strong for unscrupulous hunters to sneak in from adjoining States and pose as citizens of Wyoming; and an officer must rely upon his acquaintance with the people of his own county for detection of such fraud.

Whatever may be said of the injustice of requiring nonresidents to take out licenses to hunt on their own property or on the lands of a club to which they may belong, the contention that such a provision is unconstitutional in depriving a person of his property has not been sustained in the single case which has been tried in the higher courts. (*In re* Eberle, see p. 48.)

Another provision frequently regarded as an unnecessary hardship is that even after securing a license nonresidents are sometimes prohibited from carrying home any of the game which they secure. Such restrictions are in force in Delaware, Florida, Kentucky, Maryland, Michigan, New Jersey, North Dakota, Pennsylvania, Utah, and West Virginia, and also in Manitoba. In other States which issue nonresident licenses an exemption in the nonexport law allows the holder to take with him out of the State a certain amount of game for his own use, usually on condition that it shall be carried openly. Some such provision seems no more than just when the State exacts a fee of from $5 to $50 for the privilege of securing game, which, in some cases at least, can not be fully enjoyed unless the owner can take it home.

The absence of such a provision and the failure to permit nonresident landowners to hunt on their own property account for most of the irritation aroused by nonresident license laws. The shipping privilege can be easily arranged and has already been recognized by most States. The other obstacle is not so easily overcome, and a satisfactory solution has not as yet been devised.

OBJECTS OF HUNTING LICENSES.

NONRESIDENT LICENSES.

The objects of nonresident licenses, although variously stated, may be practically reduced to two: (1) To restrict hunting, especially on the part of those who are not citizens of the State, and (2) to raise funds for game protection by requiring nonresidents to contribute to the expense of preserving the game. The annoyances occasioned by hunting on the part of irresponsible persons who are not citizens of the State are by no means peculiar to the present day. They were evidently experienced by the early colonists, as shown by the preamble of the North Carolina law of 1768, in which the reasons for discriminating against nonresidents are quaintly expressed as follows:

> Whereas, by the before recited act, [Laws of 1745, Chap. III], persons who have no settled habitation, or not tending 5000 cornhills are prohibited from hunting, under the penalty of five pounds and forfeiture of his gun; which by experience has been found not to answer the purposes intended by the said act; many disorderly and dissolute persons having no habitation of their own, still continue to hunt on the King's waste and the lands of other persons, and kill deer, and leave the carcasses in the woods, by which means the wolves, bears and other vermin, are fed and raised; to the great damage of many of the inhabitants of this Province; and the fines being difficult of recovery, by means of persons having no property of their own, assembling in great numbers and camping in the woods, and kill deer, burn and destroy the range, burn fences and commit many other injuries to the inhabitants of this Province; and associate for the mutual protection and defence of each other, against any person or persons who shall attempt to execute any precept on any of them: * * *

The necessity for restricting hunting is now greater in some States than in others, particularly in those which are likely to be overrun with hunters from large cities in adjoining States. New Jersey affords a striking example of this kind. A State of comparatively small area, with New York City on her northern border and Philadelphia on her southwestern border, her stock of game is peculiarly subject to depletion by hunters from these cities, and a nonresident license fee affords a means of preventing many of them from hunting in the adjoining counties within her borders. The fact that Pennsylvania, Delaware, and other States had adopted the license system induced New Jersey to follow their example. The reason for this course was thus expressed in the preamble to the act of 1902 (Laws of 1902, chap. 263):

> Whereas, Sister states have, by legislation, required all non-residents (including residents of the state of New Jersey) to take out licenses before hunting or gunning in such states, respectively, and imposed license fees therefor and provided for the punishment for such as should violate the provisions of such acts; now, therefore,
>
> *Be it enacted by the State and General Assembly of the State of New Jersey:*
>
> 1. Every non-resident of this state shall be required to take out a license before he shall begin hunting or gunning in this state, * * *

Pennsylvania in 1903 further developed the protection idea by requiring not only every nonresident, but also every unnaturalized foreign-born resident of the Commonwealth to take out a license from the treasurer of the county in which he proposed to hunt, for which he must pay a fee of $10. (Acts of 1903, p. 178.) This provision, which has recently been adopted by Louisiana, seems to offer a practical solution of the problem of controlling the ever increasing number of foreigners of certain classes who destroy birds and game of all kinds in the neighborhood of large cities despite laws and wardens.

The principle on which the nonresident license is founded, besides the general one of protection of the game from irresponsible and unidentifiable hunters on which all hunting licenses are based, is the preservation of the benefits of residence within a community for the use of its own citizens. The game of a State is held to belong to the people of the State and is preserved primarily for their own use. When, therefore, nonresidents desire to enjoy the privileges of residents they are required to pay a reasonable fee for such concession on the part of the State. This requirement is the one which is considered more important by some States. Thus Illinois in the game law of 1901, section 26, declares:

> For the purpose of increasing the game-protection fund, and preventing unauthorized persons from killing game and birds, no person, not a resident of the State of Illinois, shall at any time hunt, pursue or kill, with gun, any of the wild animals, fowls or birds that are protected during any part of the year without first having procured a license so to do, * * *

In several States, notably Maine, North Carolina, Washington, and Wyoming, the State depends largely upon the income from this source for game protection; in most States although the returns are considerable they do not by any means constitute the chief source of income for the game-protection fund. Efforts have been made to ascertain the income derived from licenses in the several States, as well as in the Provinces of Canada, for the years 1902 and 1903. Difficulty, however, has been encountered in obtaining satisfactory statistics owing chiefly to the different methods of issuing licenses and the fact that in some States the issue is intrusted to local officers, so that the full returns for the State are practically inaccessible. The following table shows the number of licenses and amount of fees received therefor in 22 States and 6 Provinces during the past two years. In several States license laws were not in force in 1902, and in others statistics for 1902 are not available, although they have been furnished for 1903.[a]

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[a] The figures for Washington are inseparable from those for resident licenses and are given in the table on p. 38. The States and Provinces from which no returns were received are: New York, Pennsylvania, Florida, Indiana, Iowa, South Dakota, Oregon, Hawaii, British Columbia, and Quebec. In New York no licenses were issued, and in Oregon the law requires none except for market hunting by nonresidents. The receipts were probably small in all the other States except possibly in South Dakota.

Nonresident Licenses issued in 1902 and 1903.

State.	Rate.	1902.			1903.			Remarks.
		No.	Amount.	Total amount.	No.	Amount.	Total amount.	
Colorado	$25.00	......	......	......	29	$725.00	$746.00	General license.
	......	......	......	......	5	21.00		Bird license, $1 per day ($2 first day).
Delaware	5.00	246	$791.00	$791.00	315	1,027.00	1,027.00	
	2.00							
Idaho	25.00	(a)	(a)	(a)	20	500.00	1,735.00	
	5.00				247	1,235.00		
Illinois	10.00	570	5,985.00	5,985.00	250	3,750.00	3,750.00	Rate in 1903, $15.
Kentucky	25.00	4	100.00	100.00	......	......	......	4 counties.
Maine	15.00	(a)	(a)	(a)	1,697	25,455.00	25,455.00	
Maryland	......	......	......	151.50	......	......	131.50	Total number, 25 in 1902, 25 in 1903.
Caroline	4.50	2	9.00	......	2	9.00	......	
Cecil	5.00	16	80.00	......	14	70.00	......	
Dorchester	5.00	......	......	......	1	5.00	......	
Howard	7.50	3	22.50	......	3	22.50	......	
Kent	5.00	2	10.00	......	5	25.00	......	
Montgomery	15.00	2	30.00	......	......	......	......	
Michigan	25.00	53	1,325.00	1,325.00	45	1,125.00	1,125.00	
Minnesota	25.00	......	......	......	131	3,275.00	5,295.00	
	10.00	......	......	......	202	2,020.00		
Montana	25.00	33	825.00	970.00	61	1,525.00	1,690.00	
	15.00	9	145.00		11	165.00		
Nebraska	10.00	64	640.00	640.00	84	840.00	840.00	
New Hampshire	10.00	(a)	(a)	(a)	135	1,350.00	1,350.00	
New Jersey	10.00	......	......	......	301	3,010.00	3,010.00	
North Carolina	10.00	(a)	(a)	(a)	911	9,110.00	9,110.00	
North Dakota	25.00	......	......	......	83	2,075.00	3,075.00	First district.
	25.00	......	......	......	40	1,000.00		Second district.
Ohio	25.00	15	375.00	375.00	17	425.00	425.00	
Tennessee	......	(a)	(a)	(a)	40	200.00	325.00	Total includes 5 market hunters' licenses, $125.
Utah	10.00	(a)	(a)	(a)	30	300.00	300.00	
Virginia[b]	10.00	(a)	(a)	(a)	254	2,540.00	2,540.00	
West Virginia	15.00	......	......	......	29	435.00	435.00	
Wisconsin	25.00	293	7,325.00	9,925.00	361	9,025.00	......	All game.
	10.00	260	2,600.00		298	2,980.00	12,005.00	Small game.
Wyoming	50.00	......	......	......	158	7,900.00	7,900.00	
Manitoba	25.00	36	900.00	900.00	30	750.00	750.00	
New Brunswick	30.00	287	8,610.00	8,610.00	338	10,140.00	10,140.00	
Newfoundland	100.00	46	4,600.00	4,600.00	72	3,600.00	3,600.00	Rate in 1903, $50.
Northwest Ter.	15.00	19	285.00	285.00	17	255.00	255.00	
Nova Scotia	40.00	33	1,320.00	1,510.00	30	1,200.00	1,380.00	
	10.00	19	190.00		18	180.00		
Ontario	25.00	200	5,000.00	5,000.00	259	6,475.00	6,475.00	

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[a] No law in force.

[b] Based mainly on a report by L. T. Christian in the Richmond Times-Dispatch of August 21, 1904, supplemented by a few reports from county clerks. Following are the number of licenses issued in each county in 1903: Albemarle, 2; Alexandria, 13; Alleghany, 1; Augusta, 4; Amelia, 16; Bath, 4; Brunswick, 6; Bland, 4; Buckingham, 9; Caroline, 18; Charlotte, 2; Culpeper, 2; Dinwiddie, 1; Essex, 7; Fairfax, 5; Fauquier, 2; Franklin, 2; Frederick, 4; Gloucester, 2; Greensville, 4; Henrico, 8; Isle of Wight, 1; James City, 2; King William, 10; Louisa, 4; Lunenburg, 6; Middlesex, 13; Montgomery, 1; New Kent, 3; Nottoway, 2; Orange, 3; Page, 4; Pittsylvania, 2; Prince George, 12; Princess Anne, 44; Prince William, 1; Richmond, 5; Roanoke, 2; Shenandoah, 1; Smyth, 2; Southampton, 1; Spottsylvania, 1; Stafford, 5, and Sussex, 13. Total, 254. The only counties not heard from are Accomac, Giles, Hanover, Mecklenburg, and Powhatan.

The foregoing table shows that the number of licenses issued was as follows: In 1902, 1,572 licenses in 9 States and 640 licenses in 6 Canadian Provinces, or a total of 2,212 licenses in 15 States and Provinces; in 1903, 5,779 licenses in 21 States and 764 licenses in 6 Canadian Provinces, or a total of 6,543 licenses in 27 States and Provinces. While the receipts from nonresident licenses in 1903 exceeded those of the previous year, they ran above $1,000 in only 14 States and 4 Provinces, and exceeded $5,000 in only 5 States and 2 Provinces. Maine collected the largest amount ($25,455) and Wisconsin the next largest ($12,005). The smallest amount was $131, collected in Maryland, where licenses were issued in only 5 of the 23 counties.

Investigation of the disposition of the funds will show that in most cases receipts from licenses are utilized for the protection of game. Maine, in 1903, provided that the money received from nonresident licenses should be expended for protection of moose and deer and for compensation for "actual damage done growing crops by deer." In a few States, however, the proceeds are turned into the general treasury or the school fund. Thus, in New York, West Virginia, Kentucky, Tennessee, Oregon, and Utah they are covered into the general treasury, and in Georgia into the county treasury. In Pennsylvania one-half of the total receipts is paid into the county treasury. In North Dakota 20 per cent goes into the general treasury, 10 per cent is paid to the county auditor, and 70 per cent is added to the game fund. In Maryland (except in a few counties) and Nebraska the receipts are turned over to the school fund. Again, examining the table from this standpoint, it will be noticed that the States which turn the money over to the school fund or to the general treasury are the ones which show the smallest returns. Thus, in 1903, Maryland collected only $131 and Nebraska $840 for the school fund. Utah collected $300 and West Virginia $435 for the general treasury. Where the money is not applied to the protection of game, which is the ultimate source of this income, less interest seems to be taken in enforcing license laws, and the license system as a source of income makes but a small showing. Again, the experience of some States shows that interest is apt to be lax if the proceeds from the sale of licenses are turned into a general State fund instead of being retained in the county in which they accrue, even though such general fund is devoted to the enforcement of game laws, and it has been suggested as desirable to allow each county to use for its general expenses at least 50 per cent of the proceeds, and thus give it a direct financial interest in the amount raised.

RESIDENT LICENSES.

Resident licenses, unlike those issued to nonresidents, are not intended so much to restrict hunting as to regulate it. The chief uses they subserve are raising funds for the protection of game and providing a system of identifying hunters. And by requiring everyone who hunts to be registered, they may afford indirectly a valuable means of collecting statistics not otherwise obtainable, concerning the number of persons hunting in the State, approximately the amount of big game killed, and the principal hunting places.

With the exception of a small fee allowed to the officer issuing the license, usually prescribed in addition to the regular license fee, the proceeds from resident licenses are used for the protection of game. Apparently the only important exceptions are in North Dakota and Michigan. In North Dakota, but 70 per cent is devoted to game protection, 10 per cent being paid to the auditor and 20 per cent to the general treasury of the State. In Michigan 25 cents is allowed the clerks for issuing the licenses, so that the cost to the State of collecting the fees is 33 per cent of the total resident tax.

The following table shows the number of resident licenses issued in each State in 1902 and 1903 and the amounts paid therefor:

Resident Licenses issued in 1902 and 1903.[a]

State.	Rate.	1902.		Rate.	1903.		Remarks.
		No.	Amount.		No.	Amount.	
Colorado	....	....	....	$1.00	15,184	$15,184.00	
Hawaii	$5.00	....	....	5.00	....	....	
Idaho	....	....	....	1.00	12,370	12,370.00	
Illinois	....	....	....	1.00	95,000	95,000.00	
Indiana	....	....	....	1.00	....	....	
Michigan	$0.75	18,621	$13,965.75	.75	19,061	14,295.75	
Minnesota	.25	....	....	1.00	8,910	8,910.00	
Nebraska	1.00	3,348	3,348.00	1.00	3,744	3,744.00	
North Dakota	.75	....	....	.75	6,518	4,888.50	First district.
				.75	5,056	3,792.00	Second district; total $8,680.50.
South Dakota	1.00	....	....	1.00	....	....	
Washington	1.00	....	....	1.00	14,982	14,982.00	
Wisconsin	1.00	72,635	72,635.00	1.00	78,164	78,164.00	
Wyoming	1.00	....	....	1.00	299	299.00	
New Brunswick	2.00	1,571	3,142.00	2.00	1,858	3,716.00	Moose and caribou.
Ontario	5.00	150	750.00	5.00	153	765.00	Do.
	2.00	5.165	10,330.00	2.00	5,707	11,414.00	Deer.
Quebec	5.00	....	....	5.00	....	....	

[a] In Maryland special licenses were issued in some of the counties as follows: Anne Arundel, 1902, 11 pushers, $22; 1903, 10 pushers, $20; Cecil, 1902, 24 sink box, $480; 67 sneak boat, $335; 1903, 19 sink box, $380; 69 sneak boat, $345; Harford, 1902, 40 sink box, $800, 68 sneak boat, $340; 1903, 34 sink box, $680; 51 sneak boat, $255.

COMPARISON OF STATISTICS.

A comparison of the two preceding tables shows some interesting facts. Although the returns are incomplete, still they suggest some important questions in regard to (1) receipts, (2) number of licensed hunters, (3) number of big game licenses, and (4) statistics of former years.

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[a] Maine is the only State in this list that does not issue resident licenses.

(1) *Receipts.*—The receipts from licenses exceeded $10,000 in nine States: Colorado, Idaho, Illinois, Maine,[a] Michigan, Minnesota, North Dakota, Washington, and Wisconsin. Notwithstanding the difference in the fees charged, a nominal fee of $1 for resident licenses and an average fee of $10 to $25 for nonresident licenses, the amount ordinarily collected from residents is far in excess of that received from nonresidents. Thus, in Wisconsin in 1903 the returns from resident licenses ($78,164) were more than six times as great as those from nonresident licenses ($12,005); in Colorado, where the amounts were $15,184[a] and $746, respectively, the resident were nearly twenty-one times as large as the nonresident; and in Illinois, the amounts being $95,000 and $3,750, respectively, more than twenty-five times as large.

(2) *Number of licensed hunters.*—In the following table are shown the number of licenses issued (indicating the number of licensed hunters) and the amounts received therefrom (see Pl. V) in each of the 10 States for which statistics are available for both resident and nonresident licenses:

Number of Licensed Hunters and Receipts from Licenses, 1903.

State.	Resident.	Nonresident.	Total number.	Total fees.
Colorado	15,184	34	15,218	$15,930
Idaho	12,370	267	12,637	14,105
Illinois	95,000	250	95,250	98,750
Michigan	19,061	45	19,106	15,421
Minnesota	8,910	333	9,243	14,205
Nebraska	3,744	84	3,828	4,584
North Dakota	11,574	123	11,697	11,756
Washington	14,982	(a)	14,982	14,982
Wisconsin	78,164	659	78,823	90,169
Wyoming	299	158	457	8,199
Total	259,288	1,953	261,241	288,101

[a] Nonresident licenses inseparable from resident licenses.

The most interesting fact brought out by this table is the total number of licenses issued. This number shows that in the above-mentioned ten States more than a quarter of a million hunters were licensed during the past year. This total, however, is less than the actual number of hunters in these States, for the reason that in Michigan and Wyoming no licenses are required from residents for anything except big game, and in Nebraska and Wyoming a resident is not required to secure a license unless he shoots outside his own county.

The only State which shows larger returns from nonresident than from resident licenses is Wyoming, which has a very high nonresident fee of $50, and requires resident licenses only in the case of persons

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[a] Deducting the fees for issue the amount was $9,890.

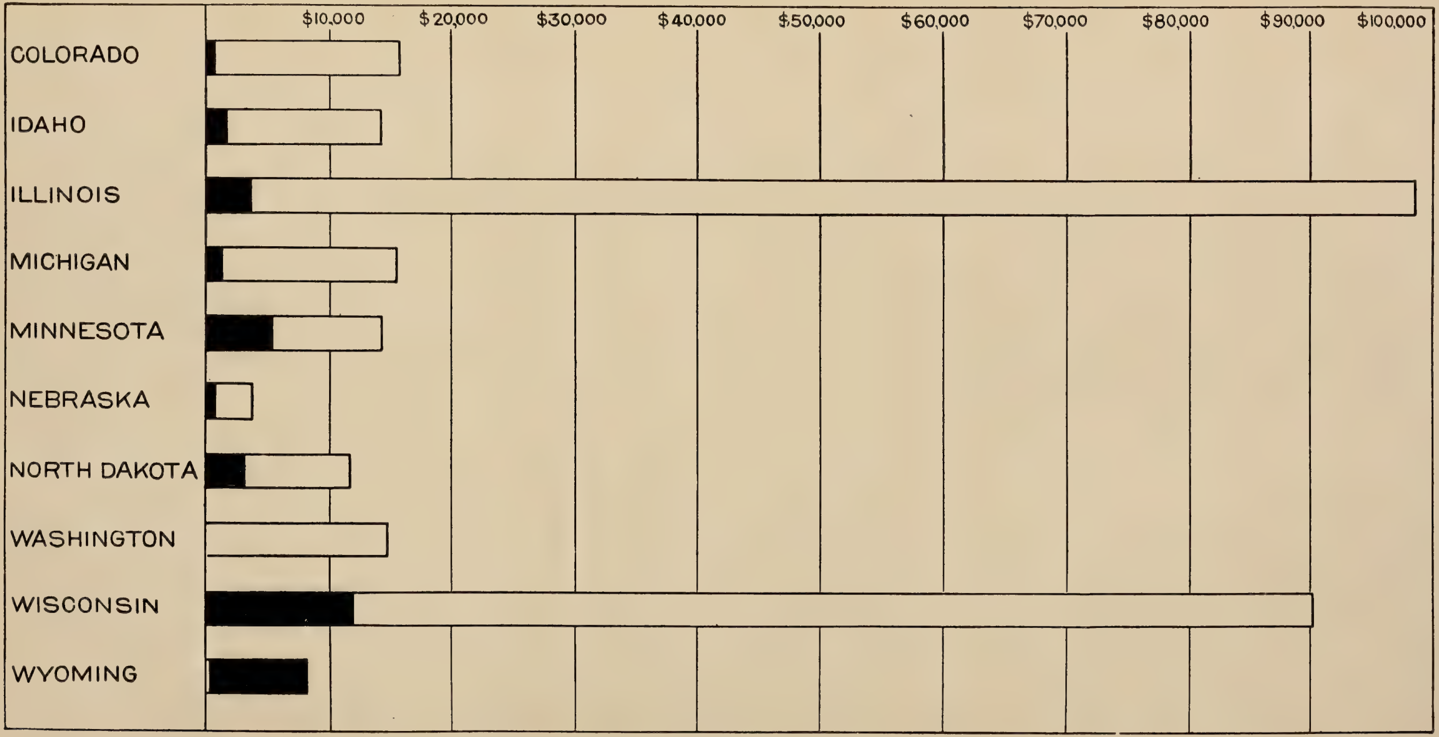


DIAGRAM SHOWING RECEIPTS FROM LICENSES IN TEN STATES, 1903.

Black indicates receipts from nonresident licenses; white, receipts from resident licenses. For exact amounts see pages 34 and 36.

hunting big game outside of the county of residence (see p. 32). These conditions in a State so thinly settled and with large counties would naturally make the returns from resident licenses very small.

(3) *Number of big game licenses.*—As some of the States require separate licenses for big game and for game birds, it is possible to ascertain approximately the number of nonresident licenses issued for hunting big game. The figures for 9 States and 4 Provinces are shown in the table following:

Nonresident Licenses for Big Game issued in 1903.

State.	Licenses.	Fees.
Colorado	29	$725
Idaho	20	500
Maine	1,697	25,455
Michigan	45	1,125
Minnesota	131	3,275
Montana	61	1,525
New Hampshire	135	1,350
Wisconsin	361	9,025
Wyoming	158	$7,900
New Brunswick	338	10,140
Newfoundland	72	3,600
Nova Scotia	30	1,200
Ontario	259	6,475
Total	3,336	72,295

From this table are omitted the returns from Nebraska, North Dakota, Utah, Washington, West Virginia, Manitoba, and the Northwest Territories, in which licenses for big game can not be separated from those for game birds. Several other States, in which considerable big game hunting is done, are also necessarily omitted—South Dakota, British Columbia, and Quebec, from which no reports are available, and Vermont, New York, California, and Oregon, in which no general hunting licenses are issued. But notwithstanding the incompleteness of the statistics, several facts of interest are brought out. Thus, it appears that in the nine States and four Provinces in the table 3,336 nonresident big game licenses were issued at a cost of $72,295, that Maine issued more than one-half of these licenses and collected more than one-third of the fees, and that New Brunswick stood second in point of license receipts. If we assume that all the nonresident licenses in Nebraska, North Dakota, Utah, West Virginia, Manitoba, and the Northwest Territories were issued for big game hunting, the totals would only be increased to 3,649 and $78,120, respectively, leaving but six important States—New York, South Dakota, California, Oregon, Washington, and British Columbia, in addition to those in the South—from which no returns are available. In other words, nearly 60 per cent of the 5,779 nonresident licenses issued in the United States and most of those issued in Canada in 1903 were for hunting big game.

On the other hand, if the resident licenses could be separated in the same way, the results would be very different. Fortunately, in five cases these figures are available, as resident licenses are issued only for big game in Michigan, Minnesota, Wyoming, New Brunswick, and Ontario. In 1903 there were 19,061 resident licenses issued in Michigan, 8,910 in Minnesota, 299 in Wyoming, 1,858 in New Brunswick, and 5,860 in Ontario, making a total of 35,888, or nearly ten times as many as were issued to nonresidents in the nineteen States and Provinces mentioned above. The amount paid for the resident licenses, however, was only $39,400, or about 50 per cent of the fees for the nonresident licenses.

(4) *Statistics of former years.*—Still another inquiry suggested by the table is whether or not the figures for 1903 are abnormal. On this point few statistics are available for a term of years, but in Michigan and Ontario the returns are complete for the entire time the resident-license system has been in force. Michigan inaugurated its license system in 1895; Ontario began to issue nonresident licenses in 1888 and resident licenses in 1896.[a] The rates are about the same—$25 for nonresidents in each case and 75 cents for residents in Michigan and $2 in Ontario. Situated as they are, adjoining one another, with much the same kind of hunting, this State and Province are admirably adapted for a comparison of this kind.

Following are the figures for each year since 1895:

Number of Licenses issued in Michigan and Ontario,[a] 1895–1903.

Year.	Michigan.			Ontario.		
	Resident.	Nonresident.	Total.	Resident.	Nonresident.	Total.
1895	14,477	22	14,499	....	60	....
1896	12,904	20	12,924	3,452	49	3,501
1897	11,867	44	11,911	2,300	53	2,353
1898	11,585	48	11,633	3,300	52	3,352
1899	12,758	93	12,851	3,917	80	3,997
1900	13,366	77	13,443	4,200	90	4,290
1901	15,687	49	15,736	5,090	100	5,190
1902	18,621	53	18,674	5,165	200	5,365
1903	19,061	45	19,106	5,707	259	5,966
Total	130,326	451	130,777	33,131	943	34,014
Average	14,481	50	14,531	[b] 4,141	105	[b] 4,502

[a] Ontario also established a $5 resident license for moose and caribou in 1900. Comparatively few of these licenses have been issued—105 in 1900, 150 in 1902, and 153 in 1903—and as Michigan has no corresponding license, they have been omitted from this table.

[b] Average for 8 years, 1896–1903.

This table shows that the total number of hunters licensed in Michigan since 1895 was 130,777, and in Ontario since 1896, 34,014. Although the number varies from year to year, there has been a steady increase in resident licenses for six or seven years—in Michigan from 11,585 in 1898 to 19,061 in 1903, and in Ontario from 2,300 in 1897 to 5,707 in 1903. The number of nonresident licenses shows considerable fluctuation—in Michigan from 20 in 1896 to 93 in 1899, in Ontario from 49 in 1896 to 259 in 1903.

While the issue of nonresident licenses in Ontario has increased regularly and to larger proportions than in Michigan, the issue of resident licenses has always been considerably smaller. This is explained in part by the fact that in 1896 the government began the issue of free settlers' permits, allowing one member of a family to kill two deer for food purposes. In 1897, 2,300 of these permits were issued, in 1898, 2,404, and in 1899, 2,665. But even if the settlers' permits and resident licenses are combined, the total will still be less than one-half the number of resident licenses issued in Michigan for the same year.

LIMITATIONS OF THE LICENSE SYSTEM.

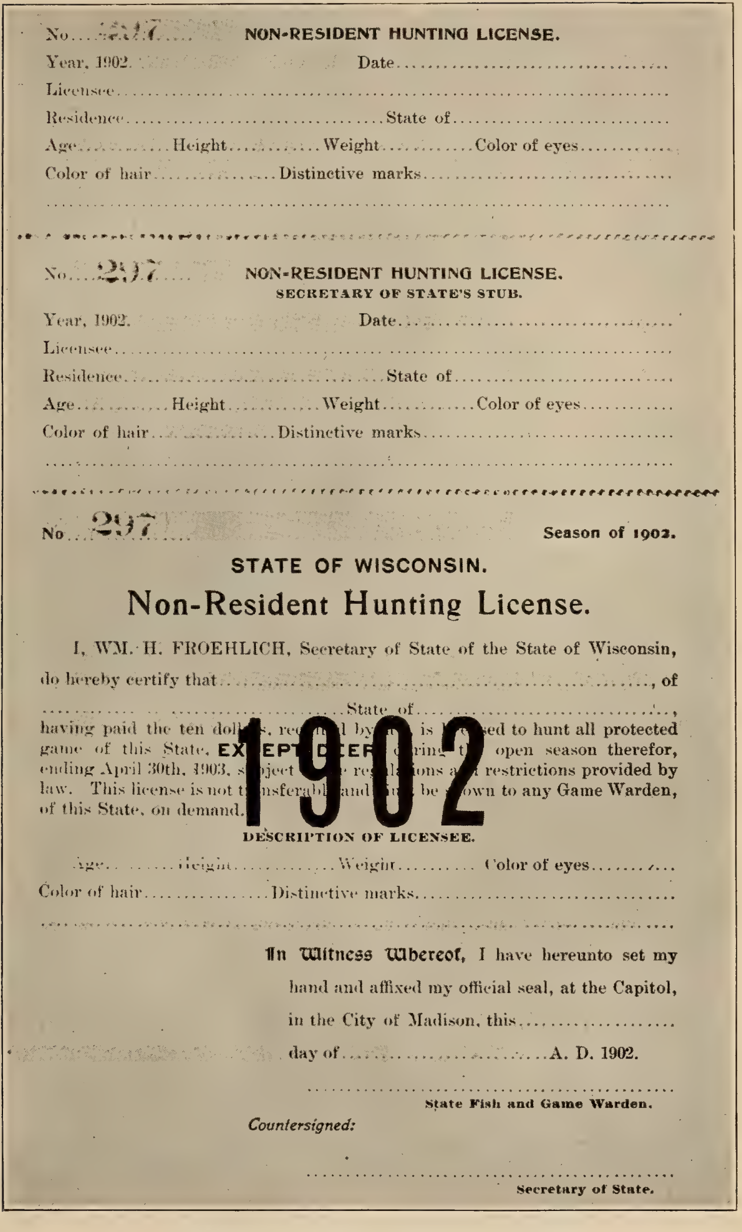
In many States the license system is still in an experimental or transitional stage, and its possibilities as a source of revenue, a check on indiscriminate hunting, and incidentally as a means of collecting important statistics concerning hunting, have not been fully realized. It is, moreover, incomplete in some States, where it has not been extended to residents or does not cover all kinds of game. These inequalities are inherent in any new scheme and may be expected to disappear in due time. Certain other inherent difficulties, however, give rise to problems which are not so readily solved. These may be grouped under three heads: Special privileges, cost of collection, and enforcement.

SPECIAL PRIVILEGES.

Much of the adverse criticism provoked by the license system has been caused both by the privileges granted and by those withheld by law. Certain exemptions already referred to (pp. 30–32) arouse hostility to the system and undoubtedly interfere with its operation. On the other hand, failure to accord reasonable privileges, which might be granted without impairing the value of the law, has created irritation and intensified opposition. The exceptional privileges granted residents of certain limited districts or members of certain clubs are regarded, perhaps with justice, as class legislation. The omission to exempt taxpayers from the requirements of the law, however, sometimes works injustice and arouses strong criticism. Both of these extremes are at least of doubtful constitutionality, and seem to prevent the best working of the system. Exemption of landowners or taxpayers is in many cases necessary, but to devise a clearly constitutional means for accomplishing it without interfering with the main object of the law is one of the difficult problems still to be solved. A lesser evil, which can be more easily remedied, is the policy established in some States of exacting a large fee for a hunting license and refusing the licensee the privilege of carrying home even a limited amount of the game or trophies he has secured. This is a source of irritation that apparently serves no useful purpose, and might easily be removed.

COST OF COLLECTION.

Although comparatively unimportant, the expense of printing licenses is an item that must be taken into account in considering the cost



No. 297 **NON-RESIDENT HUNTING LICENSE.**

Year, 1902. Date

Licensee

Residence State of

Age Height Weight Color of eyes

Color of hair Distinctive marks

No. 297 **NON-RESIDENT HUNTING LICENSE.**

SECRETARY OF STATE'S STUB.

Year, 1902. Date

Licensee

Residence State of

Age Height Weight Color of eyes

Color of hair Distinctive marks

No. 297 **Season of 1902.**

STATE OF WISCONSIN.

Non-Resident Hunting License.

I, WM. H. FROEHLICH, Secretary of State of the State of Wisconsin, do hereby certify that , of

State of ,

having paid the ten dol s, re l by is ed to hunt all protected game of this State, EX EPT E ER rin t open season therefor, ending April 30th, 1903, s bject re l ions a restrictions provided by law. This license is not t nsferabl and be own to any Game Warden, of this State, on demand.

1902

DESCRIPTION OF LICENSEE.

Age Height Weight Color of eyes

Color of hair Distinctive marks

In Witness Whereof, I have hereunto set my hand and affixed my official seal, at the Capitol, in the City of Madison, this day of A. D. 1902.

State Fish and Game Warden.

Countersigned:

Secretary of State.

NONRESIDENT COUPON LICENSE OF WISCONSIN.

Size 5 by 8¼ inches, printed on light-blue glazed paper, and mounted on linen. (The $25 nonresident deer license is similar but bright red.)

of collection of license fees. Sometimes it becomes a considerable item, especially in the case of a modern coupon license mounted on cloth and furnished with metal eyelets for attaching the coupons to the game killed (see Pl. VI). The method of issuing a license varies according to the State, and the fees allowed officers that issue them are strikingly different. When licenses are issued by game commissioners or wardens who receive no special fees the cost of issue is merely the added cost of clerical service. The usual method of issuing them through county officers who are allowed a certain percentage, or a specified fee, for their work oftentimes greatly reduces the income, particularly in the case of resident licenses, in which the fees for issue are large in proportion to amount of the license. In Wyoming the rate is 5 per cent of the license fee, or 5 cents for issuing a resident license and $2.50 for a $50 nonresident license. In North Dakota the rate is 10 per cent. In Michigan a clerk is allowed a uniform fee of 25 cents for issuing the 75 cent resident license and the $25 nonresident license, or 33 per cent in one case and 1 per cent in the other. Thus in 1903 it cost the State only $11.25 to collect $1,125 from nonresidents, while it cost $4,765 to collect $14,296 from residents. As the cost of issue is frequently deducted from license receipts, the actual income is seriously reduced. The cost of collecting license money should in all cases be reduced to a minimum, in order to insure adequate funds for game protection, and if the percentage plan is adopted the maximum fee allowed for issuing the license should be limited to $1.

ENFORCEMENT.

Penalties for hunting without a license, like fees for issuing licenses, exhibit considerable variation. Thus the penalty in North Dakota is $20 to $50, or imprisonment not exceeding thirty days; in Wyoming, $25 to $100, or ten to ninety days' imprisonment; in Minnesota, $50 to $100, or thirty to ninety days' imprisonment, or both; in South Dakota, $25 to $200, and not more than thirty days' imprisonment, with forfeiture of both gun and game. In all these States except Wyoming the general nonresident license costs $25. If, as in some of the cases just mentioned, the minimum penalty is about the same or less than the license fee it encourages violation of the law. Unprincipled hunters will risk detection and a fine that does not exceed the license rate on the chance of escaping any payment. This difficulty may be overcome by making the minimum fine sufficiently large; thus $10 in the case of residents and at least twice the license fee in that of nonresidents should have a sufficiently deterrent effect. Confiscation of gun, boat, or other paraphernalia may cause vigorous resistance to the law on constitutional grounds, in which the contestant may be sustained by the courts. The plan of holding the hunting outfit as security for payment of the fine, however, as provided in some laws, is of a different character, and may be employed with much better results.

The question naturally suggests itself as to how far license laws, and especially those relating to nonresidents, are enforced. Unfortunately statistics on the point are too meager to furnish reliable conclusions; still such as are obtainable are interesting, as indicating that the laws are certainly not violated with impunity. Thus for hunting without a license there were 9 convictions in Montana in 1902; in New Jersey 9 convictions in 1902 and 45 arrests in 1903; in Pennsylvania 23 arrests in 1902, and in West Virginia 5 convictions in 1901 and 8 in 1903. Recently a sportsman from Homestead, Pa., who had been indicted for hunting squirrels out of season in West Virginia, was arrested and taken, under extradition papers, to Morgantown, W. Va., where he was fined $25 and costs for hunting without a nonresident license. He was also required to deposit $110 as a guarantee of his appearance at the next term of court to answer the indictment.[a] In Canada hunting without a license frequently results in arrest. In Ontario 26 arrests were made and 21 convictions secured in 1901, and 9 convictions in 1902; 5 guns, 1 rifle, and 1 boat in the possession of unlicensed hunters were also seized in 1901.

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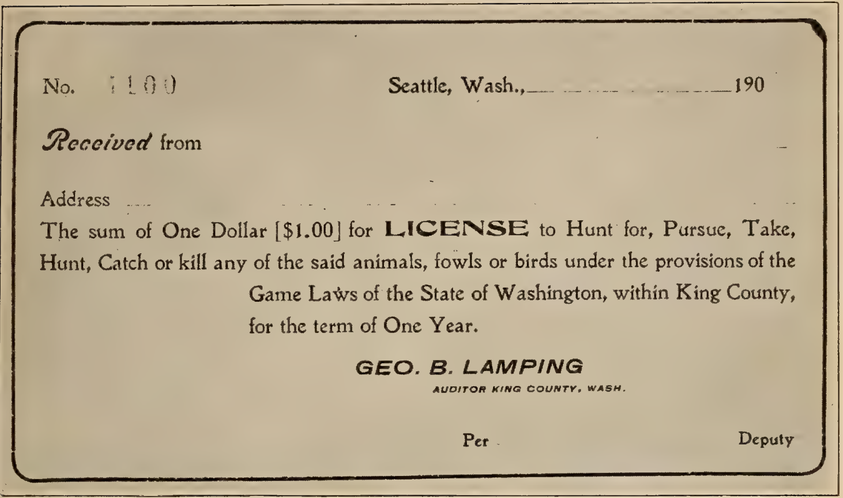
[a] Letter dated September 17, 1904, from Deputy Warden Bennett S. White, who conducted the case.



No. 1100 Seattle, Wash., 190

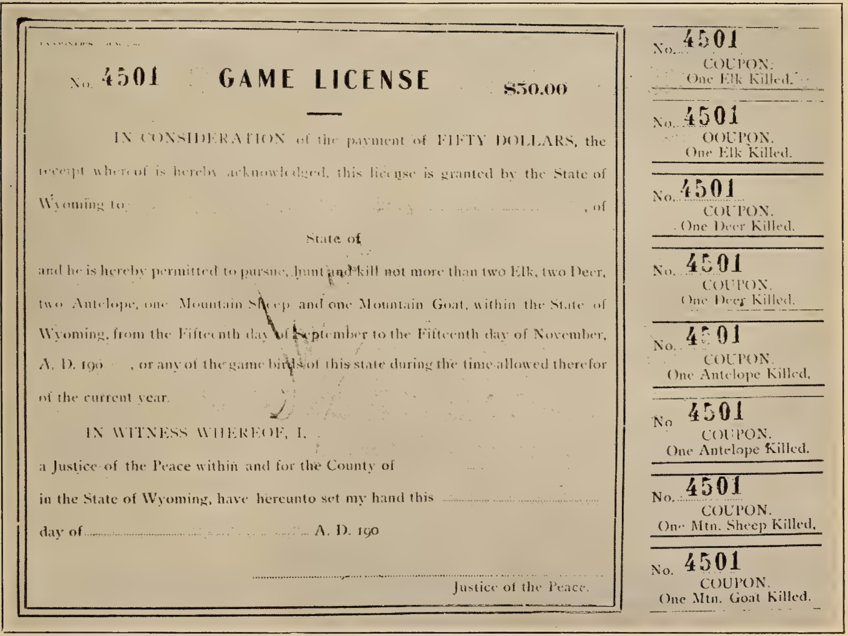
Received from

Address

The sum of One Dollar [$1.00] for **LICENSE** to Hunt for, Pursue, Take, Hunt, Catch or kill any of the said animals, fowls or birds under the provisions of the Game Laws of the State of Washington, within King County, for the term of One Year.

GEO. B. LAMPING
AUDITOR KING COUNTY, WASH.

Per Deputy



No. 4501 **GAME LICENSE** $50.00

IN CONSIDERATION of the payment of FIFTY DOLLARS, the receipt whereof is hereby acknowledged, this license is granted by the State of Wyoming to , of

State of

and he is hereby permitted to pursue, hunt and kill not more than two Elk, two Deer, two Antelope, one Mountain Sheep and one Mountain Goat, within the State of Wyoming, from the Fifteenth day of September to the Fifteenth day of November, A. D. 190 , or any of the game birds of this state during the time allowed therefor of the current year.

IN WITNESS WHEREOF, I, a Justice of the Peace within and for the County of in the State of Wyoming, have hereunto set my hand this day of A. D. 190

Justice of the Peace.

No. 4501 COUPON. One Elk Killed.

No. 4501 COUPON. One Elk Killed.

No. 4501 COUPON. One Deer Killed.

No. 4501 COUPON. One Deer Killed.

No. 4501 COUPON. One Antelope Killed.

No. 4501 COUPON. One Antelope Killed.

No. 4501 COUPON. One Mtn. Sheep Killed.

No. 4501 COUPON. One Mtn. Goat Killed.

EXTREMES OF NONRESIDENT LICENSES, 1903—THE $1 LICENSE OF WASHINGTON AND THE $50 LICENSE OF WYOMING.

The Washington license is 3¾ by 6¾ inches, printed on white paper, with an extract from the law on the back; the Wyoming license is 6 by 8 inches and printed on white paper.

PRESENT STATUS OF LICENSE LEGISLATION.

From a small beginning in a few States nonresident licenses have steadily increased in number during the past ten years, until at the present time they are required in 31 States and Territories,[a] and in practically all the Provinces of Canada. Since 1895 the adoption of resident licenses has spread to 13 States and 3 Canadian Provinces.

As a rule, nonresident licenses are required for hunting any game, but in Michigan, New Hampshire, New Brunswick (except Westmoreland County), and Newfoundland they are necessary only for big game. Great variety exists in the form of the license, in detail of issue, and in the accompanying privileges, but there is a tendency toward the adoption of more uniform fees and of the so-called coupon license, which provides the holder not only with a permit to hunt but also tags to insure the safe shipment of his game. The fees range from $1 to $50 (see Pl. VII), but in most cases the rate is $10 for birds and $25 for big game and birds. In a few States the maximum rate has recently been reduced to $15. The majority of States now permit the licensee to carry with him out of the State a reasonable amount of game obtained under his license.

Resident licenses are required in most of the States along the northern border from Michigan westward. Ordinarily the fee is $1, but in a few States it is only 75 cents, and in Hawaii $5. These licenses were first required only for hunting big game, but in most States their use has now been extended to cover hunting all game.

In some cases the receipts, particularly from resident licenses, have furnished a much larger income for game protection than was anticipated, and several States now depend largely on this source of revenue for maintenance of their warden service. With adequate license laws properly enforced, the work of game protection may be made practically self-supporting.

Naturally some opposition has been manifested to the adoption of the license system. Questions have been raised as to the constitutionality of the laws affecting nonresidents and some of these questions are still unsettled.

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[a] In addition to these States, Georgia and Oregon require nonresidents engaging in market hunting to secure licenses. Market-hunting licenses are issued to residents, only in Georgia, Louisiana, and Tennessee.

DECISIONS OF THE COURTS ON NONRESIDENT LICENSE LAWS.[a]

Several cases have been decided in State courts involving directly or indirectly the validity of nonresident hunting licenses, but the question has not yet been directly decided by the Supreme Court of the United States. As there is no immediate prospect of such a decision[b] it may be interesting at least to review briefly the precedents which have already been established and to refer to one or two decisions of the Supreme Court in analagous cases, which indicate to some extent what the attitude of that court would be if the question were directly before it. But first it should be explained that the chief grounds of attack on the constitutionality of nonresident licenses are the clauses in the Federal Constitution prohibiting taxes or duties on articles exported from any State (Art. I, sec. 9), guaranteeing to citizens of each State all the privileges and immunities of citizens of the several States (Art. IV, sec. 2), and prohibiting legislation "which shall abridge the privileges or immunities of citizens of the United States, * * * or deny to any person within its jurisdiction the equal protection of the laws." (Amend. XIV.)

While nonresident license laws have been declared void in a few cases, they have been so declared by inferior courts or on technical grounds and not by the highest courts or on the merits of the question. In 1886 the circuit court of Craighead County, Ark., declared the Arkansas act of 1875 unconstitutional (Am. Field, XXVII, p. 49, Jan. 15, 1887). In April, 1887, the circuit court of Poinsett County, Ark., held the same act unconstitutional, and as a consequence judgment was rendered against the sheriff of the county for $10 and costs in each of 18 cases in which he had collected $10 license fees from nonresidents. (Am. Field, XXVIII, pp. 3-4, July 2, 1887.) In 1901 the superior court of Spokane County, Wash., declared the Washington law unconstitutional because it discriminated in not requiring boys under 16 years of age to be licensed, and in 1903 declared a subsequent nonresident license law void on account of a defect in the title. (Field and Stream, VIII, p. 501, Oct., 1903.) None of these cases was appealed to the supreme court, and the decisions, therefore, even had they directly considered the license principle, could not be considered as furnishing authoritative precedents. In 1903 the circuit court of Crittenden County, Ark., declared the Arkansas law prohibiting nonresidents from hunting in the State unconstitutional in so far as it prohibited nonresidents from hunting on their own land. (Am. Field, LX, p. 52, July 18, 1903.) This case has been appealed to the supreme court of Arkansas, but the decision has not yet been rendered. In May, 1904, a case (Cummings *v.* People) which may result in a decision on the nonresident license question, was carried to the supreme court of Illinois on writ of error. One of the contentions in this case, which involves the constitutionality of the Illinois game law of 1903, is that the statute is invalid because it discriminates between resident and nonresident hunters.

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[a] See also article on 'Nonresident Licenses,' by William A. Talcott, jr., in Forest and Stream, L, pp. 205-206, March 12, 1898.

[b] In December, 1902, the 'American Field' started a fund for the purpose of defraying the costs of carrying a test case to the Supreme Court, but during the first eight months collected only about $160. (Am. Field, LVIII, pp. 593, 597, 1902; LX, p. 145, 1903.)

On the other hand two decisions have been rendered by higher courts which uphold the constitutionality of such laws, one by the supreme court of New Jersey in 1886 and the other by the United States circuit court of the northern district of Illinois in 1899. In the former case (Allen *v.* Wyckoff, 48 N. J. Law Rep. 90; 2 Atl. 659) one Allen was arrested and fined $50 for violating the act for the protection of game and game fish approved April 4, 1878, which imposed greater restrictions and severer penalties upon nonresidents of the State than upon residents. The case was appealed to the supreme court of New Jersey, which held that the act in question was not in violation of the fourteenth amendment of the Constitution of the United States, prohibiting any State from making any law which shall abridge the privileges of citizens of the United States or deny to any person the equal protection of the laws; and furthermore that the statute was valid in its application to a nonresident killing game on the property of persons who have formed an association under the laws of the State for the protection of game on their own property.

In passing upon the question of constitutionality, after showing that section 2 of Article IV of the Constitution, and so much of the fourteenth amendment as secures the privileges and immunities of a citizen of the nation were not applicable to the case in hand, as Allen was not a citizen of the United States, the court said:

> The only clause of the federal constitution, therefore, which, on the surface seems to have any pertinency is that forbidding a state to deny to any person within its jurisdiction the equal protection of the laws. But even this appearance is dissipated, I think, when we examine the decision of the supreme court of the United States in the Slaughter-house Cases, 16 Wall. 36. It was there argued that a state law which authorized a corporation to establish stock-yards and slaughter-houses in and near New Orleans, and prohibited all other persons from slaughtering cattle or keeping stock-yards elsewhere, within an area of about 1,154 square miles around the city, was an infringement of this fourteenth amendment; that the right to use one's land, skill, and labor in any lawful business for the acquisition of property

was a fundamental civil right, which, according to any just theory of government, was entitled to the protection of the law; that, therefore, while the right might of course be regulated by state legislation, this amendment required that the laws for such purpose should operate equally upon all persons within the jurisdiction; and that the statute, securing such a right to some persons, and denying it to others in substantially similar situation, was invalid. But the court decided that laws of this nature were not within the purview of this clause of the amendment; that it had been framed to remedy the evils arising from the existence of laws in the states where the newly-emancipated negroes resided, which discriminated with gross injustice and hardship against them as a class; and that this design must be kept in view in determining the scope and effect of the provision; the learned justice who spoke for the court saying: 'We doubt very much whether any action of a state not directed by way of discrimination against the negroes as a class, or on account of their race, will even be held to come within the purview of this provision. It is so clearly a provision for that race and that emergency, that a strong case would be necessary for its application to any other.' * * *

Bearing in mind, then, this indication of the scope of the amendment, afforded by the ultimate arbiter of its construction, how can it be said that the statute now under review is interdicted by it? * * * The statute seems to stand in the same category as the Louisiana act, as an exercise of the police power for the regulation of one of the modes of acquiring property; and, as such, it might be embraced within the terms of the amendment, by giving them their widest signification, but, restricted as the supreme court declares their meaning to be, they do not touch the matter in hand. No rights of the prosecutor under the federal constitution therefore seem to be infringed.

In the Illinois case, *In re* Eberle (98 Fed. 295), the validity of the nonresident license was directly decided. Frank Eberle, a citizen of Iowa and a member of the Crystal Lake Club, an Illinois corporation authorized to acquire and own real estate in Illinois for use as a game and fish preserve, was arrested when hunting on the lands of the club. He was charged with hunting without a license in violation of the State law requiring a license of $10 from nonresidents, passed in 1899 subsequent to the incorporation of the club. At the trial the defendant was adjudged guilty of violation of the statute and was sentenced to pay a fine of $25 and costs and stand committed until the fine was paid. An unsuccessful application was made to the United States circuit court for a writ of habeas corpus.

In denying the writ the court held:

The sovereign ownership of wild game is in the state, in trust for the benefit of its citizens; and a statute requiring the payment of a license by a nonresident for the privilege of hunting such game within the state is a police regulation within the power of the state, and not in violation of article 4, sec. 2, of the federal constitution, or of section 1 of the fourteenth amendment, although such fee is not required of residents of the state; nor is the validity of such regulations as to a particular individual, who is a nonresident of the state, affected by the fact that he is a stockholder in a corporation of the state which owns lands maintained as a game preserve.

Several important decisions are on record sustaining statutes prohibiting nonresidents from taking oysters. As early as 1823 the United States circuit court upheld the New Jersey oyster law of 1820

(Corfield *v.* Coryell, 4 Wash. C. C. 371). This is a leading case on the subject. In 1855 the supreme court of Rhode Island sustained a similar statute of that State passed in 1844, which prohibited nonresidents from taking oysters within the waters of Rhode Island. In 1873 the supreme court of New Jersey upheld the New Jersey act of 1846 (Haney *v.* Compton, 36 N. J. L. 507), and in 1901 again upheld a similar statute passed in 1899 (State *v.* Corson, 50 Atl. 780). In rendering the decision in the Haney case the court said:

> A full ownership of this species of property empowers the State to declare who shall take it, upon what terms it shall be taken, and by what means it shall be removed. A citizen of Pennsylvania cannot claim a right to acquire the property of New Jersey in a manner different from that to which New Jersey agrees to dispose of it.

The Supreme Court of the United States has upheld the public ownership of game and has quoted with approval the decision of the supreme court of California (*Ex parte* Maier) to the effect that—

> The wild game within a State belongs to the people in their collective sovereign capacity. It is not the subject of private ownership except in so far as the people may elect to make it so; and they may, if they see fit, absolutely prohibit the taking of it, or traffic and commerce in it, if it is deemed necessary for the protection or preservation of the public good. (Geer *v.* Connecticut, 161 U. S. 529.)

The same court has, moreover, decided, in the case of McCready *v.* Virginia (94 U. S. 248), that a State may pass laws discriminating against nonresidents, by upholding, in 1877, a statute of Virginia (act of 1846) which absolutely prohibited nonresidents from planting oysters in the waters within the limits of the State. In rendering the opinion of the court Chief Justice Waite said:

> The precise question to be determined in this case is, whether the State of Virginia can prohibit the citizens of other States from planting oysters in Ware River, a stream in that State where the tide ebbs and flows, when its own citizens have that privilege.
>
> The principle has long been settled in this court, that each State owns the beds of all tide waters within its jurisdiction, unless they have been granted away. * * *
>
> By article IV., sec. 2, of the Constitution, the citizens of each State are 'entitled to all privileges and immunities of citizens in the several States.' * * * we think we may safely hold that the citizens of one State are not invested by this clause of the Constitution with any interest in the common property of the citizens of another State. If Virginia had by law provided for the sale of its once vast public domain, and a division of the proceeds among its own people, no one, we venture to say, would contend that the citizens of other States had a constitutional right to the enjoyment of this privilege of Virginia citizenship. Neither if, instead of selling, the State had appropriated the same property to be used as a common by its people for the purposes of agriculture, could the citizens of other States avail themselves of such a privilege. And the reason is obvious; the right thus granted is not a privilege or immunity of general but of special citizenship. It does not 'belong of right to the citizens of all free governments,' but only to the citizens of Virginia, on account of the peculiar circumstances in which they are placed. They, and they alone, owned the property to be sold or used, and they alone had the power to dispose of it as they saw fit. They owned it not by virtue of citizenship merely, but of

citizenship and domicil united; that is to say, by virtue of a citizenship confined to that particular locality.

The planting of oysters in the soil covered by water owned in common by the People of the State is not different in principle from that of planting corn upon dry land held in the same way. Both are for the purposes of cultivation and profit; and if the State, in the regulation of its public domain, can grant to its own citizens the exclusive use of dry lands, we see no reason why it may not do the same thing in respect to such as are covered by water. And as all concede that a State may grant to one of its citizens the exclusive use of a part of the common property, the conclusion would seem to follow, that it might by appropriate legislation *confine the use of the whole to its own People alone.*

HUNTING LICENSES IN FOREIGN COUNTRIES.

For purposes of comparison with the license system of the United States and Canada, particularly in the matter of fees, reference may be made briefly to the conditions surrounding hunting in a few foreign countries. In general it may perhaps be said that hunting licenses are required in a majority of civilized countries, except those under the control of Spanish-speaking nations. In Europe licenses to hunt or to carry firearms are generally required, and in some countries, as for example, Prussia, distinctions are made between residents and nonresidents. Without going into the subject in detail it will suffice to mention by way of illustration the license systems of Great Britain and Germany for Europe, Japan for Asia, New Zealand for Australasia, and the colonies of German East and Southwest Africa, Sudan, and Transvaal for Africa. It will be observed that the issue of hunting licenses is not restricted to the older countries of Europe where game is scarce, but has been extended to colonies in the heart of Africa which have only recently come under European control and where large game is more abundant than anywhere else in the world.

GREAT BRITAIN.

For shooting in Great Britain three or even four licenses must be taken into consideration. Separate licenses are required for killing game, for carrying a gun, and for the use of a dog, and in addition, a gamekeeper's license may be necessary. Game and gun licenses are the only ones requiring consideration in this connection. Both are excise licenses, and enforcement of the regulations regarding them is in the hands of the commissioners of inland revenue. Under the act of 1860, "licenses to kill game"[a] are issued throughout Great Britain and Ireland for one year, ending July 31, at a cost of £3 ($15), or for a period of six months, at £2 ($10), or for fourteen days, at £1 ($5). These licenses may be obtained at most post-offices. They are not required for netting or trapping woodcock and snipe, for capturing rabbits and hares, or for hounding or hunting deer on inclosed lands with the owner's permission. Members of the Royal family and the King's gamekeepers are exempt from the provisions of the law, and a further exemption is made of unarmed assistants of licensees.

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[a] This is the designation in England and Scotland. In Ireland the earlier term of 'certificates' is still retained.

Under the act of 1870, every person who uses or carries a gun is required to secure a license unless he has a license to kill game. Gun licenses may be obtained at money-order offices, and, like game licenses, are good throughout the United Kingdom. These licenses are issued for one year, expiring July 31, at a cost of 10 shillings ($2.50). A gun license is not required in case of members of the naval, military, or volunteer service, of any person carrying a gun belonging to the holder of a gun or game license, or where guns are used to kill vermin or frighten birds by occupants of lands, or are carried by gunsmiths or common carriers in connection with their regular business.

GERMANY.

Under the law of July 31, 1895, several forms of licenses (Jagdscheine) are issued for hunting in Prussia. A resident may obtain an annual license on payment of 15 marks ($3.75), or one good for three days for 3 marks (75 cents). A foreigner or nonresident—that is, a person who has no domicile or owns no property in Prussia—must pay 40 marks ($10) for an annual license and 6 marks ($1.50) for a three-day license. Officers in the forest service are furnished free licenses good for a year. In either case the holder must own land on which he can hunt or must have an invitation from some one who owns a preserve. Each license has its own distinctive color—yellow for the annual, red for the daily, white for the gratuitous, and the same colors, but with a black background, for the nonresident. Each has a diagram printed on the back, showing the open and close seasons for each kind of game, and is good throughout Prussia, except in the island of Heligoland.

NEW ZEALAND.

Under the animals protection act of 1880 hunting game is prohibited except under license. These licenses are good only during the open season and within the district for which issued. The license fees, not to exceed 50 shillings ($12.50), are fixed by notification of the governor.

JAPAN.

Under the general game law of Japan two series of licenses are issued: (A) For capture of live game with net or lime, and (B) for killing game with a gun. Each of these licenses is issued in three classes, distinguished by different colors; and these classes are based upon the amount of taxes paid by the holder. First-class licenses (buff) are issued to persons paying not less than 100 yen ($50) income tax, 500 yen ($250) land tax, or 150 yen ($75) business tax. To such persons or the members of their families the fee is 20 yen ($10). Second-class licenses (green) are issued to persons paying not less than 3 yen ($1.50) income tax, 30 yen ($15) land tax, or 20 yen ($10) business tax, and the fee for such persons or the members of their families is 10 yen ($5). Third-class licenses (red) are issued to persons who are not included in the first and second classes. All these licenses are printed on pieces of thin cardboard somewhat larger than ordinary postal cards. On the face of the license are shown the number and class and the season for which issued; the status, domicile, occupation, name, and age of the holder; and the seal of the department of agriculture and commerce. On the back is printed an abstract of the game law, showing the close seasons, the birds protected at all times, and the conditions under which hunting is permitted.

GERMAN EAST AFRICA.

Under the ordinance of July, 1903, hunting licenses are required in the German East African hunting district. The fee is 10 rupees[a] ($3.25), but applicants who have no permanent residence in the district are required to make a deposit of 500 rupees before the license is issued. In addition, special fees are required for hunting the following kinds of game: 1 rupee for each dwarf antelope; 3 rupees for each gnu, hartebeest, waterbok, rappenantilope, certain other kinds of antelope, kudu, oryx, ape (*Colobus*), or marabu; 10 rupees for each leopard; 20 rupees for each buffalo, hippopotamus, or lion; 30 rupees for each rhinoceros, and 100 rupees for each elephant.

These licenses are good only during the calendar year in which issued, are not transferable, and may be refused to applicants who, during the five years preceding their application, have been guilty of violating the game or certain other laws of the district.

GERMAN SOUTHWEST AFRICA.

Under the ordinance of 1902 licenses are issued under certain conditions for hunting in German Southwest Africa. As in similar cases elsewhere, these licenses are issued for one year, are valid throughout the hunting district, are not transferable, and are to be obtained in the district of which the person is a resident. The fee is 30 marks ($7.50). If the applicant is not a resident of the district, permits may be obtained from the government. When hunting is carried on in connection with a regular expedition a special license must be obtained, the fee for which is 1,000 marks ($250) per year unless suspended by special order of the government.

SUDAN.

In the Sudan two forms of licenses are issued for hunting. License A costs £25 ($125), and entitles the holder to capture or kill a limited number of any of the common and some of the rarer species of big game, including several kinds of antelope and some of the larger birds. Special fees, varying from 250 milliemes ($1.25) to 50 pounds Egyptian ($256)—in the case of rhinoceroses—are required for killing certain animals, and extra taxes are collected for the shipment of trophies of various species. License B costs but £5 ($25), and allows the holder to kill 10 specimens each of wild sheep, ibex, wart hog, certain species of antelope, and large bustards.

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[a] The rupee is equivalent to about 32½ cents.

TRANSVAAL.

In the Transvaal, under the game ordinance of 1902, a license is required to hunt in any part of the colony, except by owners or lessees of land hunting on their own property. The fee for this license is £3 ($15) for the whole season, or £1 ($5) for a period not exceeding two weeks. Certain game, such as elephants, hippopotamuses, buffaloes, several of the rarer antelopes, giraffes, rhinoceroses, quaggas, zebras, ostriches, and cranes can not be hunted without a special permit from the Colonial Secretary, and such permit must bear a £25 ($125) stamp.

INDEX OF LICENSE LEGISLATION IN THE UNITED STATES AND CANADA, 1872-1904.

The following index is arranged chronologically to show the progress of license legislation in the United States and Canada. An attempt is here made to bring together in a brief summary all the important acts, including those prohibiting nonresidents from hunting, which have been passed in the various States and Provinces since 1872, apparently the date of the first hunting-license law in the United States. Various restrictions were imposed on nonresidents much earlier than this, but no attempt has been made to collect these laws systematically. The more important ones, with their references, are noted on pages 10–12.

The number of statutes mentioned in the following list is about 160, of which over 50 are local laws of Maryland. Each entry is accompanied by a brief statement of the important provisions of the law and a reference to the volume and chapter or page, so that the original statute may be readily consulted, if necessary.

[An asterisk * indicates the first law of the kind in the State or county.]

1872. Maryland.—$20 licenses * required for sink boxes and $5 licenses * for sneak boats used in hunting wild fowl on the Susquehanna flats in Cecil and Harford counties. Licenses issued only to residents. (Laws of 1872, chap. 54.)

1873. New Jersey.—Nonresident license * required to hunt in Atlantic, Camden, Cape May, Cumberland, Gloucester, or Salem counties. Fees, $5 first year and $2 in subsequent years. (Acts of 1873, chap. 470.) Repealed March 23, 1896.

1875. Arkansas.—$10 market hunting license * required of nonresident trappers, hunters, seiners, or netters of fish. (Acts of 1875, p. —.) Fee increased in 1897. Privilege of hunting entirely withdrawn from nonresidents in 1903.

Florida.—$25 nonresident county license * required for hunting game to carry out of the State. A party of six persons hunting together included under one license on payment of an additional $5 each. (Acts of 1875, chap. 2055.)

1876. Maryland.—

Anne Arundel.—$30 licenses * issued to residents only to use sink boxes in hunting waterfowl on the waters of the county. (Laws of 1876, chap. 78.)

Anne Arundel and Prince George.—Nonresidents prohibited * from hunting in Anne Arundel and Prince George counties without permission from landowners. Penalty, $5 fine and forfeiture of gun. (Ibid., chap. 309.)

1877. Missouri.—Nonresidents prohibited * from hunting game for sale or export. (Laws of 1877, p. 333.)

Tennessee.—Nonresidents of Obion and Lake counties prohibited * from killing wild fowl for market on Reelfoot Lake. (Laws of 1877, chap. 145, sec. 1.)

1878. **Maryland.**—

Cecil.—$10 license* required of residents of Cecil County for use of sink boxes on Elk and Bohemia rivers. (Laws of 1878, chap. 292.)

Fee for sink-box license on Susquehanna Flats in Cecil County, reduced from $20 to $10. (Ibid., chap. 292.)

New Jersey.—Nonresidents prohibited* from hunting any game except waterfowl without complying with the by-laws of the game protective societies organized or to be organized under the laws of the State. (Laws of 1878, chap. 184, sec. 1.)

New Brunswick.—$20 nonresident license* required for hunting any animals or birds in the Province. Licenses good until September 1 following date of issue. Fee for officers of army or navy, $5. (Laws of 1878, chap. 45, secs. 26–29.)

1879. **Delaware.**—Nonresidents required to secure certificates of membership* in the Delaware Game Protective Association before hunting in the State. Fees, $5 the first year, $2 in subsequent years. (Laws of 1879, chap. 111, sec. 6.)

Missouri.—Nonresidents prohibited from hunting within the State. (Rev. Stat. 1879, I, sec. 1618.)

Tennessee.—Hunting game for profit prohibited* in Cumberland, Fentress, Morgan, Scott, Campbell, Overton, Putnam, White, Roane, Carroll, Rhea, Bledsoe, and Van Buren counties. (Laws of 1879, chap. 133, sec. 1.)

Virginia—Nonresidents of the State prohibited* from hunting or trapping partridges in Accomac or Northampton counties without written consent of owners or occupants of the lands. (Acts of 1879, chap. —.)

1880. **Maryland.**—

Cecil and Kent.—$10 license* required of residents of Cecil and Kent counties for the use of sink boxes on Sassafras River. (Laws of 1880, chap. 42.)

Patuxent River.—Nonresidents of Anne Arundel, Calvert, Charles, Prince George, and St. Mary counties prohibited* from shooting snipe, ortolan, and wild fowl on the Patuxent River. (Ibid., chap. 176.)

Queen Anne.—$10 license* required of residents of Queen Anne County for use of sink boxes on waters of county. Licensee prohibited from allowing use of sink box to nonresident under penalty of $20–$100, and (in case of nonresident) confiscation of sink box and other paraphernalia. In case of resistance the penalty is $50–$100. (Ibid., chap. 370.)

1882. **Maryland.**—

Anne Arundel.—Licenses* at $2 each (and clerk's fee of 50 cents) required for the use of 'booby' or 'bush' blinds on the Severn, South, and Magothy rivers. (Laws of 1882, chap. 400.)

Caroline.—$4.50 nonresident license* required for hunting rabbits, muskrats, quail or partridges, woodcock, sora or water rail; and ducks in Caroline County.

Quebec.—$20 nonresident licenses* required for hunting in the Province. (45 Vic., chap. 15, secs. 17–18.)

1883. **North Carolina.**—Nonresidents of the State prohibited from shooting wild fowl in Currituck and Dare counties from blind, box, battery, or float on the water.

1884. **New York.**—$10 nonresident license* required for hunting on Staten Island (Richmond County). (Laws of 1884, chap. 185.) Repealed in 1892.

South Carolina.—$25 market-hunting license* required for each nonresident hand employed by nonresidents hunting ducks, fishing, gathering oysters or terrapins, or selling game in Beaufort, Berkeley, Charleston, Colleton, and Georgetown counties. (Laws of 1884, p. 734.)

1884. **Nova Scotia.**—$30 nonresident license* required for killing moose and other game, and $10 nonresident license* for killing birds. All licenses expire August 1. Fee for officers in Her Majesty's service $5, but members of Game and Inland Fishery Protection Society exempt. (Rev. Stats., 5th ser., chap. 76, sec. 26.)

Quebec.—$20 nonresident license required for hunt in the province, but in exceptional cases lieutenant-governor in council may grant hunting permits at a less rate or gratuitously. License not required of Ontario hunters. (47 Vic., chap. 25, sec. 20.)

1885. **South Carolina.**—Market-hunting license provisions of 1884 modified to add to the $25 license for each nonresident hand a $25 nonresident license for pursuing the business.

1886. **Maryland.**—

Anne Arundel and Prince George.—$6 nonresident license* for hunting rabbits, partridges, and woodcock. Guest hunting on land of host exempt. (Laws of 1886, chap. 190.)

Baltimore.—$10 nonresident license* for hunting rabbits or woodcock. (Ibid., chap. 538.)

Caroline.—$19.50 license required of nonresidents for hunting rabbits, muskrats, quail or partridges, woodcock, sora or water rail, or ducks. (Ibid., chap. 505.)

Kent.—$4.50 nonresident license* for hunting any game. Guest hunting on land of host exempt. (Ibid., chap. 135.)

Queen Anne.—$4.50 nonresident license* for hunting any game. Guest hunting on land of host exempt. (Ibid., chap. 88.)

Talbot.—$9.50 nonresident license* for hunting any game protected by the county. (Ibid., chap. 442.)

Virginia.—Nonresidents prohibited* from killing wild fowl from skiff, float, or sink box in Fairfax, Henrico, King George, Prince William, or Stafford counties. Guns, boats, or sink boxes to be forfeited. Law not applicable to nonresidents renting shores on broad waters of Back Bay. (Acts of 1886, chap. 383.)

Wyoming.—Nonresidents prohibited* from hunting game animals in the State. (Laws of 1886, chap. 109.) Repealed in 1895.

1887. **Quebec.**—$5 resident licenses* issued for killing 5 caribou and 5 deer more than legal number. Commissioner of Crown lands may exempt from payment of the fee any Indian whose poverty has been established to his satisfaction. Nonresident license fee of members of hunting and fishing clubs incorporated in the Province reduced to $10. Limit on big game which may be killed under license. (50 Vic., chap. 16, secs. 3 and 12.)

1888. **Maryland.**—

Caroline.—$4.50 fee restored for nonresident license, and owners of real estate in county exempted from requirements of license law.

Charles.—$20 nonresident license* required for hunting rabbits, partridges, or woodcock. Penalty, $20, or ten days and forfeiture of gun, ammunition, and other apparatus. (Not needed by one hunting by written permission of landowner.) $25 nonresident license for hunting wild fowl on waters of county. (Laws of 1888, chap. 352.)

Dorchester.—$5 nonresident license* required for hunting rabbits, partridges, or woodcock. (Not needed by owners of land in county, or their relatives, nor by relatives or connections by marriage of residents.) (Ibid., chap. 29.)

Howard.—$7.50 nonresident license* for hunting any game. (Not needed by one hunting under written permission of landowner.) (Ibid., chap. 90.)

1888. **South Carolina.**—Nonresident market-hunting license fees increased to $500, and $100 additional for each nonresident hand employed.

Ontario.—Nonresidents prohibited from killing deer prior to 1895 unless they have secured a $10 license* from the commissioner of Crown lands. Law not applicable to shareholders in an incorporated company hunting on lands of said company. (51 Vic., chap. 36, sec. 16.)

1889. **Tennessee.**—Nonresidents of the State prohibited* from hunting game for profit in certain counties and from hunting at all in others. (Laws of 1889, chap. 179, sec. 1; chap. 244, sec. 2.)

Nonresidents of certain counties prohibited from killing game for market in these counties. (Ibid., chap. 244, sec. 2.)

Nonresidents of the State prohibited from killing wild fowl on Reelfoot Lake. (Ibid., chap. 156, sec. 1.)

Newfoundland.—$100 nonresident license* required for killing caribou. Officers of British war ships stationed on the coast for fisheries protection exempt from license. (Deer preservation act 1889, sec. 6; Con. Stat. 1892, chap. 143, sec. 6.)

1890. **Maryland.**—

Dorchester.—Nonresidents of Parson Creek, Church Creek, and Neck districts prohibited* from hunting wild fowl in the Little Choptank River. Penalty: $20 and costs, and forfeiture of boat, guns, and other "fixtures." (Laws of 1890, chap. 140.)

Somerset.—$9.50 nonresident license* for hunting any game. (Not needed by one invited and accompanied by a resident.) (Ibid., chap. 589.)

Worcester.—$10 nonresident license* for hunting wild fowl. (Ibid., chap. 446.)

British Columbia.—$50 nonresident license* required for killing big game. Limit: 10 deer, 2 bull elk, 3 reindeer, 5 caribou, 8 mountain sheep, 8 mountain goats. Members of army, navy, and Canadian militia in service in the Province require no licenses. (Game-protection act 1890, secs. 9–10.)

Manitoba.—$25 nonresident license,* good for calendar year, required for hunting animals or birds in the Province. (Game act of 1890, sec. 8.)

1892. **Maryland.**—

Anne Arundel and Prince George.—Law of 1880 (chap. 176) amended so as to restrict hunting of snipe, ortolan, and wild fowl on the Patuxent River in Anne Arundel and Prince George counties to residents of these counties, except such as have permission of a majority of the citizens adjacent to the river and employ a licensed boat. $2 pusher's license* required for pushing, paddling, or conveying nonresidents hunting on Patuxent River. Penalty: $10–$30, or, in default, confiscation of boat and fixtures. (Laws of 1892, chap. 360.)

St. Mary.—$20 nonresident license* required for hunting rabbits, partridges, and woodcock. Penalty: $20 or ten days, and forfeiture of guns and other paraphernalia. (Ibid., chap. 588.)

South Carolina.—$25 nonresident license* required for hunting in Beaufort County; Horry County added to those in which market hunting is licensed.

Virginia.—Nonresidents of the State prohibited* from killing wild fowl on the marshes, islands, or beaches below the head of tide water, except in Accomac and Northampton counties. (Laws of 1891–2, p. 1070.)

Ontario.—$25 nonresident license* required for hunting big game or birds. (Acts of 1892, chap. 58, sec. 8.)

1893. **South Carolina.**—$25 nonresident county license* required for killing game of any kind. Not required of persons hunting on their own land. (Act of December 22, 1893, sec. 3.) [Repealed by omission from Code of 1902.]

1893. Northwest Territories.—$5 nonresident license,* good until May 15 following date of issue, required for hunting big game or birds. Free licenses * may be granted to guests of residents for five days or less. (Game ordinance of 1893,[a] sec. 11.)

1894. Maryland.—

Anne Arundel and Prince George.—Laws of 1880 (chap. 176) and 1892 (chap. 360) amended by extending privilege of hunting snipe, ortolan, and wild fowl on Patuxent River to citizens of Calvert County. (Laws of 1894, chap. 586.)

Anne Arundel.—Nonresidents prohibited* from hunting in the county. Penalty: $10–$50, or, in default, one to three months, and forfeiture of gun and other apparatus. (Ibid., chap. 103.)

Baltimore.—$10 nonresident license required for hunting gray squirrels, rabbits, partridges, pheasants, and woodcock. Penalty: $10 for each bird or animal killed or in possession, forfeiture of gun to owner of property on which game is killed, and ten days in default of fine. Taxpayers and those hunting except for market under express authority on land of resident are exempt. Nonresidents prohibited from hunting or obtaining license until 1895. (Ibid., chap. 122.)

Carroll.—$10 nonresident license * required for hunting squirrels, rabbits, partridges, pheasants, and woodcock. Penalty: $10 for each animal or bird killed or found in possession, forfeiture of gun to owner of property on which game is killed, and ten days in default of fine. Taxpayers and those hunting under express authority on land of resident are exempt. (Ibid., chap. 224.)

Cecil.—Chapter 292, laws of 1878, repealed, and use of sinkboat, sneak boat, or boat of any kind on Elk and Bohemia rivers prohibited.* (Laws of 1894, chap. 556.)

Charles.—Nonresidents prohibited * from shooting wild fowl on waters of county. Penalty: $30 or thirty days, and forfeiture of guns, traps, boats, and all other devices used in violation of law. Repeal of nonresident license for shooting wild fowl; established in 1888. (Ibid., chap. 225.)

Harford.—$10 nonresident license * required for shooting rabbits, partridges, pheasants, woodcock, rail, reedbird, and robins. Taxpayers and persons hunting by invitation on land of resident are exempt. (Ibid., chap. 139.)

Kent.—$15 nonresident license required for shooting squirrels, rabbits, and birds. (Not needed by owner or tenant of land in county, and reduced to $5 in case of anyone hunting by invitation on land of resident.) (Ibid., chap. 501.

Prince George.—$20 nonresident license for shooting rabbits, partridges, and woodcock. (Ibid., chap. 542.)

Virginia.—Nonresidents of the State, except members of the Eastern Shore Game Protective Association, prohibited * from killing wild fowl in Accomac and Northampton counties. (Acts of 1894, chap. 740, sec. 2.) [The effect of this law was to make the membership fee in the association virtually a nonresident license fee.]

Nova Scotia.—Nonresident license provisions of 1884 practically reenacted. (Laws of 1894, chap. 2, secs. 29–31.)

1895. Michigan.—$25 nonresident * and 50 cent resident * licenses required for hunting deer. Licenses good only during open season, limited to 5 deer and required to have coupon attached authorizing shipment of 1 deer to any point in the State. Approved May 4, 1895. (Laws of 1895, chap. 238.)

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[a] The application of this ordinance was limited to Alberta, Assiniboia, and Saskatchewan by sec. 26 of the Unorganized Territories' Game Preservation acts of 1894 (57–58 Vic., chap. 31).

1895. **Minnesota.**—$25 nonresident license* required for hunting any game birds or animals, but law applicable only to citizens of States which have restrictive laws against nonresident hunters. Approved April 25, 1895. (Laws of 1895, chap. 207.) Repealed in 1903.

North Carolina.—$25 nonresident license* required for shooting from boxes, batteries, or floats on the waters of Dare County, south of the line from Manteo to Nagshead Life-Saving Station. (Laws of 1895, chap. 286.)

North Dakota.—$25 nonresident license* and 50 cent resident license* required for hunting any animals or birds in the State. Nonresidents cultivating not less than a quarter section of land may obtain resident license in county in which land is cultivated, and landowners hunting on their own property require no licenses.[a] (Rev. Codes, 1895, sec. 1645.)

Wyoming.—$20 nonresident county license* substituted in place of absolute prohibition in case of nonresidents hunting big game. Licenses permit killing males only during September, October, and November, and solely for food. Approved February 20, 1895. (Laws of 1895, chap. 98, sec. 14.)

British Columbia.—$50 nonresident license required for hunting big game. Members of army, navy, and Canadian militia require no license. (Game-protection act 1895, secs. 19–20.)

Quebec.—$5 resident license authorizing killing of 3 caribou and 3 deer (formerly 5) in excess of regular limits. Nonresident licenses divided into four classes: (1) For hunting all animals and birds except nongame birds, fee $30. (2) For hunting big game and fur-bearing animals, fee $25. (3) For hunting woodcock, snipe, plover, curlew, sandpipers, partridges, or water fowl, fee $20. (4) For hunting the same birds on the islands, bays, or shores of the Gulf of St. Lawrence,* fee $10. Fees reduced one-half in case of members of fish and game clubs incorporated in the Province. In exceptional cases lieutenant-governor in council, on recommendation of commissioner, may reduce fees or issue free permits. (59 Vic., chap. 20, secs. 1 and 8.)

1896. **Hawaii.**—$5 hunting license* required on the island of Oahu. (Laws of 1896, act 64.)

Newfoundland.—$100 nonresident license required for killing caribou. (Act August 6, 1896, sec. 5.)

Nova Scotia.—Modification in details of nonresident license law of 1884. $10 nonresident license required for hunting birds, hares, and rabbits, and $30 nonresident license for hunting other game. All licenses expire August 1. Fee for officers of army or navy stationed at Halifax, $5. Army or navy officers belonging to the Game and Inland Fishery Protection Society, persons who have had domicile in Nova Scotia, are in the service of the Province or of the government of Canada, and are members of the game society, and nonresidents paying not less than $20 real-estate tax, are exempt. (Laws of 1896, chap. 4, secs. 32–34; Rev. Stat., 1900, II, chap. 101, secs. 25–28.)

Ontario.—Residents required to obtain licenses* at $2 each to hunt deer in the Province. (59 Vic., chap. 68, sec. 2.)

1897. **Michigan.**—Nonresident license for deer, $25. Resident license increased to 75 cents. All licenses must bear coupons properly eyeletted; full details of issue. (Acts of 1897, p. 403.)

North Carolina.—Nonresidents of the State prohibited* from hunting birds or wild fowl in Camden County. (Laws of 1897, chap. 558, sec. 2.)

North Dakota.—Resident license fee increased to 75 cents; nonresident landowners required to secure resident licenses.

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[a] This law did not become effective until December, 1895. See Forest and Stream, XLV, p. 89, August 3, 1895.

1897. **Tennessee.**—Nonresidents of Grundy and Van Buren counties prohibited* from killing deer, quail (partridge) or wild turkey in those counties. (Laws of 1987, chap. 172.)

Wisconsin.—$30 nonresident license* and $1 resident license* required for hunting deer. Resident licenses required only in forty counties, designated as 'counties frequented by deer.' Full details in regard to issue of coupon licenses. (Laws of 1897, chap. 221.)

New Brunswick.—$20 nonresident and $2 resident licenses* required for killing moose or caribou. Nonresidents required to furnish $100 bond* with 2 resident sureties for observance of the game laws. (Acts of 1897, chap. 23, secs. 8–11.)

Quebec.—Nonresident license fees graded* according to a tariff established by the lieutenant-governor in council. Fee may be reduced in case of members of a fish-and-game club incorporated in the Province, provided club leases a hunting reserve. (60 Vic., chap. 25, sec. 5.)

1898. **Northwest Territories.**—$15 nonresident license, good only from August 1 to January 31, required for hunting any of the animals or birds mentioned by the ordinance. Guest license omitted. (Ordinance No. 40 of 1898, sec. 4; Con. Ord., 1898, chap. 85, sec. 20.)

1899. **Georgia.**—$25 market hunting license* required of any person killing or capturing for sale, except on his own land, deer, quail, wild turkeys, or doves. Not in effect until recommended by grand jury of the county. (Acts of 1899, p. 96.)

Illinois.—$10 nonresident county license, * good until June 1 following date of issue, allows shipment of 25 birds. (Laws of 1899, p. 231, sec. 26.)

Maine.—'September law,'* permitting nonresidents on payment of $6 and residents on payment of $4 to kill one deer in September, for food purposes only, in Aroostook, Franklin, Hancock, Oxford, Penobscot, Piscataquis, Somerset, and Washington counties. (Pub. Laws of 1899, chap. 42, sec. 21.)

Minnesota.—$25 nonresident license and 25-cent resident license* required for hunting deer, elk, caribou, or moose. All licenses good one year from date of issue and must contain description of licensee. (Laws of 1899, chap. 222, sec. 53.)

North Carolina.—$25 nonresident license for club houses in Dare County. (Pub. Laws, chap. 133, sec. 2.)

North Dakota.—$25 nonresident and 75-cent resident license reenacted. Exemptions same as in 1897, except that resident children under 16 are exempted. (Laws of 1899, chap. 93, sec. 4.)

South Dakota.—$10 nonresident hunter's license* required for big game or birds. (Laws of 1899, chap. 90, sec. 14.)

West Virginia.—$25 dollars nonresident county license* required for hunting in the State. (Acts of 1899, chap. 22, sec. 17.)

Wisconsin.—Nonresident license fee for hunting deer reduced to $25. $10 license* established for hunting all other game. Resident license extended to cover all game. Details of issue amended. (Laws of 1899, chap. 312.)

Wyoming.—Nonresident license fee increased from $20 to $40. $1 gun license* required of each resident hunting big game outside his own county. (Laws of 1899, chap. 19, sec. 14.)

New Brunswick.—Law of 1897 modified so as to dispense with bonding feature. (Acts of 1899, secs. 39–45.)

Newfoundland.—Nonresident license fees for killing caribou reduced, and licenses issued in three series: $40 license for 2 stags and 1 doe; $50 license for 3 stags and 1 doe; $80 license for 5 stags and 2 does. (Deer preservation act of 1899, secs. 7–10.)

1900. **Northwest Territories.**—$1 nonresident permits*, limited to 5 days, may be issued by any game guardian or the commissioner of agriculture to guests of residents hunting with their hosts. (Ordinances of 1899, chap. 23, sec. 3.)

Quebec.—Reenactment of nonresident license provisions of 1897. (62 Vic., chap. 24, sec. 1416.)

Iowa.—$10 nonresident county license,* permitting export of 25 birds or animals. (Laws of 1900, chap. 86.)

License fees to be credited to game protection fund. (Ibid., chap. 87.)

Maryland.—

Cecil.—Chapter 556, Laws of 1894, repealed, and $10 license required for use of sink box by residents on Elk and Bohemia rivers. (Laws of 1900, chaps. 372 and 444.)

Dorchester.—Nonresidents (except taxpayers) prohibited * from shooting or killing ducks, geese, brant, or swans within 1 mile of shore line of Middle or Lower Hooper Island without permission of landowners. (Laws of 1900, chap. 378.)

Garrett.—$25 nonresident license * required for hunting any game. (Laws of 1900, chap. 189.)

Somerset.—$9.50 nonresident license required for hunting any game. (Not needed by anyone invited and accompanied by a resident. (Laws of 1900, chap. 203.)

New York.—Nonresidents prohibited * from taking fish or game on fresh waters forming part of State boundary except under same conditions or fees as are required of citizens of New York in State of nonresident. (Laws of 1900, chap. 429.)

Virginia.—$10 nonresident license* required for hunting deer, partridges, pheasants, and wild turkeys in Alleghany, Augusta, Bath, Botetourt, Highland, or Rockbridge counties. License good only in county of issue, but permission of landowner obviates necessity for license. (Laws of 1900, chap. 1002, sec. 4.) $10 nonresident license required for hunting partridges (or quail) in Lee County. License carries privilege of shipping quail killed by licensee. (Ibid., chap. 330.)

Manitoba.—$25 nonresident license* required for hunting in the Province and issued at discretion of minister of agriculture and immigration. (63 and 64 Vic., chap. 14, sec. 18.)

New Brunswick.—$30 nonresident license required for hunting any animals or birds in Westmoreland County; fee for nonresident license for moose and caribou raised to $30. (63 Vic., chap. 39, sec. 3.)

Ontario.—$25 nonresident and $2 resident license provisions reenacted. $5 resident license* established for killing moose, reindeer, or caribou. (Game-protection act 1900, sec. 25.)

1901. **Illinois.**—$10 nonresident county license extended * to cover State. License must bear photograph of holder. (Laws of 1901, p. 212.)

Indiana.—$25 license* required of nonresidents. Permit required for hunting squirrels and wild fowl, October 1 to November 10. Issued without charge to residents and to nonresidents holding license. (Laws of 1901, chap. 203.)

Maine.—Repeal of the September deer law. (Pub. Laws, 1901, chap. 278.)

Minnesota.—License provisions of 1899 amended to permit residents to obtain licenses upon written (formerly personal) application to county auditor, received through office of any city, village, or town clerk before whom applicant appears. (Laws of 1901, chap. 342.)

Montana.—$25 big game license* and $15 game-bird license* required of nonresidents. Taxpayers exempt. (Laws of 1901, p. 135, secs. 19–24.)

1901. **Nebraska.**—$10 nonresident* and $1 resident licenses* required for hunting any animals or birds; resident license not required in county of domicile. (Laws of 1901, chap. 36, art. 4.)

Oregon.—$10 market-hunting license* required of nonresidents. (Laws of 1901, p. 231, sec. 38.)

Pennsylvania.—$10 license* required of nonresidents owning no land in Pennsylvania and who wish to hunt in the State. Guns and shooting paraphernalia used in violation of law may be seized. (Laws of 1901, chap. 67.)

South Dakota.—$25 nonresident and $1 resident * county licenses required for hunting big game. Licenses not to be issued before November 1 and good only during that calendar year. (Laws of 1901, chap. 132, secs. 10, 15.)

Tennessee.—Nonresidents of Bledsoe County prohibited * from hunting deer, quail (partridge), or wild turkey in that county. (Laws of 1901, chap. 213.)

Washington.—$10 nonresident license* and $1 resident license* required for hunting in the State; $20 extra for killing elk. License good only in county in which issued and required of all persons 16 years of age or over. Resident licenses may be obtained by citizens of Idaho and Oregon. (Laws of 1901, chap. 134, sec. 9.)

Northwest Territories.—$15 nonresident license, good for calendar year, required for hunting any big game or birds in the Territories whether protected by the ordinance or not. (Ordinances of 1901, chap. 32, sec. 3.)

1902. **Kentucky.**—$25 nonresident license * required for hunting in the State. (Laws of 1902, chap. 79.)

Louisiana.—Nonresidents prohibited from hunting in the State.* (Laws of 1902, chap. 65.)

Maryland—

Calvert.—$10 nonresident license * required for hunting rabbits, partridges, and woodcock. (Not needed by anyone hunting by invitation or under written permission on land of a resident.) (Laws of 1902, chap. 493.)

Cecil.—$5.50 nonresident license * required for hunting rabbits, quail or partridges, grouse, woodcock, reedbirds, ortolan (rail), and summer ducks. (Not needed by anyone hunting by permission on land of a resident.) (Laws of 1902, chap. 434.)

Dorchester.—Nonresidents prohibited from hunting ducks, geese, brant, or swan within 3 miles of shore line of Middle and Lower Hooper Island without consent of landowners.

Frederick.—$15 nonresident license * required for hunting rabbits, partridges, pheasants, wild turkeys, woodcock, and ducks. (Not needed by anyone hunting by written permission on land of a resident.) (Laws of 1902, chap. 176.)

Garrett.—Nonresidents prohibited from selling quail, pheasants, partridges, wild turkeys, and woodcock within county. (Laws of 1902, chap. 116.)

Montgomery.—$15 nonresident license * required for hunting squirrels, rabbits, partridges, pheasants, wild turkeys, woodcock, and ducks. (Not needed by anyone hunting by written permission on land of a resident.)

Prince George.—$20 nonresident license required for hunting rabbits, partridges, pheasants, and woodcock. (Not needed by anyone hunting by written permission on land of a resident.)

Washington.—$10 nonresident license * required for hunting or fishing in Washington County, except on the Potomac River. Taxpayers, residents of Maryland or the District of Columbia, and anyone hunting by permission on the land of a resident of the county are exempt. (Laws of 1902, chap. 379.)

Wicomico.—$10 nonresident license * required for hunting any game. (Not needed by anyone invited and accompanied by a resident.) (Laws of 1902, chap. 222.

1902. **New Jersey.**—$10 nonresident license* required for hunting any game except waterfowl, snipe, and mudhens. (Laws of 1902, chap. 263,)

New York.—Nonresidents from States which require licenses, can kill game only under licenses* similar to those required of nonresidents in their own States. (Laws of 1902, chap. 77.)

Ohio.—$25 nonresident license* permitting export of 50 animals and birds. (Laws of 1902, p. 379.)

Newfoundland.—Nonresident license fee increased from $80 to $100 and limit placed at 3 stag caribou. (Preservation of deer act, 1902, sec. 13.)

Nova Scotia.—Nonresident license changed to 'general license to shoot game' and fee increased from $30 to $40. 'License to shoot small game,' $10. (Laws of 1902, chap. 23, sec. 2.)

1903. **Arkansas.**—Repeal of former license laws. Nonresidents not permitted to hunt in the State* except in Mississippi County. (Acts of 1903, chap. 162, secs. 4, 11.)

Colorado.—$25 nonresident license* required for hunting all game and $1 per day ($2 first day) for birds. $1 State hunting or resident license* established. (Laws of 1903, chapter 112, Division G.)

Florida.—$10 nonresident license extended to cover all game. Act not applicable to counties which have special game laws. (Laws of 1903, chap. 5251, sec. 6.)

Nonresidents prohibited from hunting in Santa Rosa County without permission of owner of land (ibid., chap. 5292), or in Lafayette County except upon payment of $1 per day* to game warden (ibid., chap. 5293).

Idaho.—$25 nonresident license* required for hunting all game, $5 license* for birds. $1 resident license* established. (Laws of 1903, p. 192, sec. 8.)

Illinois.—Nonresident license fee increased from $10 to $15 and requirement of photograph abolished. $1 resident license* established. (Laws of 1903, p. 214, sec. 25.)

Indiana.—$25 nonresident license required for hunting in the State; permits export of 24 birds. Permit for hunting squirrels October 1 to November 10 abolished; $1 required from residents for permit* for hunting waterfowl October 1 to November 10. Both nonresident and resident licenses must bear photograph of licensee. (Acts of 1903, chap. 225, secs. 4–5.)

Maine.—$15 nonresident license* required for hunting moose or deer. (Public Laws of 1903, chap. 99.)

$5 nonresident license* required for hunting teal, ducks, sea or shore birds in Knox, Lincoln, Sagadahoc, and Waldo counties; and towns of Brunswick, Freeport, and Harpswell in Cumberland County. (Public Laws of 1903, chap. 236.)

Minnesota.—Reenactment of former license provisions with addition of $10 nonresident license* for small game; resident license extended to cover all game animals and fee increased to $1. (Laws of 1903, chap. 336, secs. 39–41.) Repeal of license laws of 1895, 1899, and 1901. (Ibid., sec. 64.)

New Hampshire.—$10 nonresident license* required for hunting deer. (Laws of 1903, chap. 87.)

New York.—Nonresident license required for hunting game. Fee not less than that required of resident of New York in State of applicant; and, if none, amount to be fixed by commissioner of forestry, fisheries, and game. (Laws of 1903, chap. 475.)

North Carolina.—$10 nonresident license* required for hunting in the State. (Private Laws of 1903, chap. 337, sec. 10.)

$20 nonresident license* required for hunting quail, partridges, or wild turkeys in Cabarrus County. (Pub. Laws of 1903, chap. 675, sec. 2.)

1903. **Pennsylvania.**—$10 nonresident license* required of unnaturalized foreign-born residents who hunt in the State. (Laws of 1903, chap. 136.)

Tennessee.—Nonresident* and $25 market hunting licenses* required for hunting in the State. Fee for nonresident license same as resident of Tennessee is required to pay in State of applicant. (Acts. of 1903, chap. 169, secs. 9, 14.)

Utah.—$10 nonresident gun license* required for hunting any game animals or birds in the State. (Laws of 1903, chap. 116, sec. 2.)

Virginia.—$10 nonresident license* required for hunting in the State. Children and guests of resident landowners exempt, but host must hunt with his guest and must not, directly or indirectly, receive any compensation from him. (Acts 1903, chaps. 227, 286, sec. 2070c.)

Washington.—Uniform $1 county license* required of residents and nonresidents hunting in the State. (Laws of 1903, chap. 94.)

West Virginia.—Nonresident license extended* to cover the State and fee reduced from $25 to $15. (Acts of 1903, chap. 46, sec. 17.)

Wyoming.—Nonresident gun license fee increased from $40 to $50. (Laws of 1903, chap. 44, sec. 8.)

New Brunswick.—Reenactment of license provisions with addition of 25 cent, resident license to hunt any game in Westmoreland County. (Con. Stat., Vol. I, chap. 33, secs. 44–46.)

Newfoundland.—Nonresident license fee reduced from $100 to $50. (Acts of 1903, chap. 8, sec. 3.)

Northwest Territories.—$25 general nonresident license and $15 bird license* required of nonresidents for hunting in the Territories. General license permits export of trophies of big game. (Ordinances of 1903, 2d sess., chap. 29, sec. 18, passed Nov. 1, 1903.)

1904. **Kentucky.**—Nonresident license fee reduced from $25 to amount required of citizens of Kentucky in State of applicant.* (Acts of 1904, chap. 48.)

Louisiana.—$10 nonresident license* substituted for absolute prohibition; same license required of unnaturalized foreign-born residents. $25 market hunting license established. (Laws of 1904, chap. —.)

Maryland—

Allegany.—$10 nonresident license* required for hunting any game. (Laws of 1904, chap. 439.)

Anne Arundel.—Previous laws modified so as to remove restrictions from nonresident owners of land in county and permit nonresident not owning land to hunt if invited by a resident and hunting with him on his own land or to shoot wild fowl from a licensed blind on invitation of owner.

Baltimore.—$5 nonresident license required for hunting squirrels, rabbits, partridges, pheasants, woodcock, and jacksnipe. Photograph of holder must be attached to license. Nonresident taxpayers and persons hunting by written permission on the land of a resident exempt. (Laws of 1904, chap. 542.)

Patuxent River.—$10 license* for hunting birds required of nonresidents, except members of certain incorporated hunting clubs, of not more than 30 members, owning or leasing land within one mile of the river and improved by a club-house. Licensee must also secure written permission of owner of land adjacent to water on which he hunts. $2.50 pusher's license required of residents of Maryland pushing, paddling, or conveying anyone hunting ortolan, rail, reedbirds, ducks, or geese. (Laws of 1904, chap. 509.)

Somerset.—$10 nonresident and $1 resident license* required (except in case of resident landholders) for hunting squirrels, rabbits, muskrats, quail or partridges, doves, woodcock, ducks, and geese. (Laws of 1904, chap. 198.)

1904. **Ohio.**—$15 nonresident license, good until December 1 following date of issue, required for hunting in the State; fee formerly $25. (Laws of 1904, p. 474, sec. 22.)

Nova Scotia.—$30 nonresident license required for hunting moose. Licensee may take with him from the Province any moose or caribou which he has lawfully killed. (Laws of 1904, chap. 14.)

REFERENCES TO ARTICLES ON NONRESIDENT LICENSES.

Much discussion of the license system has appeared in sportsmen's journals in recent years, mostly in the form of brief articles and notes, and the following list of titles, arranged chronologically, has been prepared for the convenience of persons who may desire to examine this material. No attempt has been made to give a complete index of the literature of the subject, or to do more than to indicate some of the more important articles which have been consulted in the preparation of this bulletin:

1875. A member, Game Protection in New Jersey. [Defense of the charter of the West Jersey Game Protective Association.] <Forest and Stream, V, p. 188, Oct. 28, 1875.

Editorial, Game Protection—The Florida Snap Law [Nonresident license act of 1875]. <Forest and Stream, V, p. 328, Dec. 30, 1875; see also same volume, pp. 377–378.

1880. C., Shooting Dogs and Taxing Guns. [Advocates $10–$15 Nonresident Gun License good throughout the State or in contiguous counties.] <Forest and Stream, XIII, p. 1012, Jan. 22, 1880.

1887. Editorial, The Arkansas Law Unconstitutional. [Decision of Craighead County Circuit Court.] < Am. Field, XXVII, p. 49, Jan. 15, 1887.

Anonymous, Non-Resident Shooting in Poinsett County, Arkansas. [Act of 1875 declared unconstitutional by Poinsett County Circuit Court.] <Am. Field, XXVIII, pp. 3–4, July 2, 1887.

1895. Editorial, Non-Resident Discriminations. <Forest and Stream, XLIV, p. 61, Jan. 26, 1895.

1896. Editorial, A New Jersey Scheme [for requiring nonresidents to obtain $10 licenses to hunt or fish]. <Forest and Stream, XLVI, p. 129, Feb. 15, 1896.

Robbins, C. E., North Dakota Non-Residents [fail to secure writ compelling auditor to grant licenses for same amount charged residents]. <Forest and Stream, XLVI, p. 277, April 4, 1896.

Editorial note, Snap shots [—the Michigan License System]. <Forest and Stream, XLVII, p. 1, July 4, 1896.

1897. Hough, E., The Wisconsin Deer Licenses. [Summary for 1897]. <Forest and Stream, XLIX, p. 487, Dec. 18, 1897.

1898. Talcott, William A., Jr., [Constitutionality of] Non-Resident Licenses. <Forest and Stream, L, pp. 205–206, Mar. 12, 1898.

Editorial note [Failure to pass a $2 Non-Resident License Law in New Jersey]. <Forest and Stream, L, p. 281, April 9, 1898.

Hough, E., [Abuse of] Wisconsin Deer Licenses. <Forest and Stream, LI, p. 349, Oct. 29, 1898.

1899. Cunningham, G. W., Michigan Deer [and the Operation of the License Law]. <Forest and Stream, LII, p. 10, Jan. 7, 1899.

1899. Editorial note [The Feeling engendered by Non-Resident Licenses]. <Forest and Stream, LII, p. 61, Jan. 28, 1899.

Editorial, The Wyoming Guide [and Non-Resident] License System. <Forest and Stream, LII, p. 241, April 1, 1899.

Editorial, [Non-Resident Licenses] In Florida. <Forest and Stream, LII, p. 401, May 27, 1899.

Editorial, Non-Resident License Laws are Constitutional. <Forest and Stream, LIII, p. 181, Sept. 2, 1899.

Hough, E., Illinois [Non-Resident License] Law Sustained. <Forest and Stream, LIII, p. 406, Nov. 18, 1899.

Editorial, The Non-Resident License Law Upheld. <Am. Field, LII, p. 401, Nov. 18, 1899.

1901. Johnson, F. C. [Some Hardships of Non-Resident License Laws.] <Am. Field, LV, p. 187, Mar. 9, 1901.

Anonymous, [Defense of] Non-Resident License Laws. <Am. Field, LVI, p. 206, Sept. 14, 1901.

1902. West Virginian, Hunting Licenses—Non-Resident and Resident. <Am. Field, LVII, p. 216, Mar. 8, 1902.

Editorial Note, Non-Resident License Laws. < Am. Field, LVIII, p. 145, Aug. 16, 1902.

Editorial, [A Fund] To Test the Non-Resident Law. < Am. Field, LVII. p. 593, Dec. 20, 1902.

Nowlin, D. C., Non-Resident Hunting Licenses [in Wyoming and their Results]. < Forest and Stream, LIX, p. 105, Aug. 9, 1902.

1903. Anonymous, Game Law Declared Unconstitutional [Decision of Crittenden County Circuit Court, Arkansas, on the Non-Resident Law of 1903]. < Am. Field, LX, p. 52, July 18, 1903.

Editorial, Non-Resident Land Owners [under the Arkansas Law]. < Am. Field, LX, p. 145, Aug. 15, 1903.

Anonymous, [Decision of the Superior Court of Spokane County, Washington, on the Non-Resident Law of 1903]. < Field and Stream, VIII, p. 501, Oct., 1903.

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U. S. DEPARTMENT OF AGRICULTURE
BIOLOGICAL SURVEY—BULLETIN No. 20
C. HART MERRIAM, Chief

COYOTES IN THEIR ECONOMIC RELATIONS

BY

DAVID E. LANTZ
Assistant, Biological Survey

WASHINGTON
GOVERNMENT PRINTING OFFICE
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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., March 23, 1905.

Sir: I have the honor to transmit herewith for publication as Bulletin No. 20 of the Biological Survey a report on Coyotes in their Economic Relations, prepared by David E. Lantz, assistant. The subject is of immediate importance to the sheep industry of the West, where the wasteful method of sheep herding prevails. If in the range country sheep can be fenced with coyote-proof fencing at moderate cost, as seems probable, herding may be done away with and the sustaining capacity of the lands thereby greatly increased.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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COYOTES IN THEIR ECONOMIC RELATIONS.

INTRODUCTION.

The small prairie wolves of the western and southwestern parts of North America are generally known by the Spanish name 'coyote.' This serves to distinguish them from the larger gray or dusky wolves that occur in many portions of the same range.

Intermediate in size between the foxes and the larger wolves, yet varying greatly in this respect with the different species, the coyotes are outwardly characterized by a sharp-pointed muzzle, upright ears, and a moderately long, bushy tail. The pelage is full, especially in winter. The usual color is a dirty gray, with more or less reddish tinge about the head, neck, and legs, and black hairs showing about the shoulders and on the back. The extent of the red and the black varies much with the different species.

Coyotes are generally distributed from the central Mississippi Valley to the Pacific coast and from Costa Rica on the south to the plains of the Athabasca on the north.[a] In this extensive range about a dozen species have been thus far recognized.[b] Four of these are restricted to Mexico and Central America. Of the eight forms that occur in the United States, it may be remarked that their ranges and relations to each other have not been fully determined. Much material is yet needed before anyone can write with exact knowledge of their distribution.

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[a] Edward A. Preble informs the writer that the coyote has been captured at Fort Smith, northern Athabasca (60° north latitude), and on Nelson River in northeastern British Columbia (59° north latitude).

[b] The following is a list of the forms:

1. *Canis latrans* Say. Type from Council Bluffs, Iowa.
2. *C. nebracensis* Merriam. Type from Johnstown, Nebraska.
3. *C. lestes* Merriam. Type from Toyabe Mountains, Nevada.
4. *C. frustror* Woodhouse. Type from Fort Gibson, Indian Territory.
5. *C. mearnsi* Merriam. Type from Quitobaquita, Arizona.
6. *C. estor* Merriam. Type from San Juan River, Utah.
7. *C. cagottis* H. Smith. Type from Rio Frio, Mexico.
8. *C. ochropus* Escholtz. San Joaquin Valley, California.
9. *C. peninsulæ* Merriam. Type from Santa Anita, Lower California, Mexico.
10. *C. microdon* Merriam. Type from Mier, Tamaulipas, Mexico.
11. *C. vigilis* Merriam. Type from Manzanillo, Colima, Mexico.
12. *C. goldmani* Merriam. Type from San Vicente, Chiapas, Mexico.

A group in which there is so much variation in size must also present considerable diversity of habits. The larger forms, like *C. latrans*, are, of course, the more injurious to the live-stock interests. Smaller species, like *C. estor* and *microdon*, confine themselves in their food more to the smaller wild mammals and thus do much less damage. Yet it is not the intention in this preliminary bulletin to consider the species separately. Indeed, no such detailed study of their habits has yet been made. The present paper deals with the group as a whole, and is confined to a discussion of the economic relations of coyotes in general to our agricultural interests.

In the matter of fencing to protect sheep and poultry against coyote depredations, the Biological Survey has made some preliminary investigations, and has formulated plans for more extensive experiments in the near future. In the meantime it is hoped that farmers and ranchmen throughout the West who have had personal experience of the efficiency of various forms of fence as a protection against coyotes and other wild animals will write the Biological Survey fully as to such experience.

ABUNDANCE OF COYOTES.

Coyotes are abundant in most parts of their range, except the extreme north and the more thickly populated regions where waste lands are scarce. It is, however, on the plains of the western part of the United States that they come most closely in contact with the advancing tide of settlement. The establishment of pioneer homes throughout the country has always resulted in restricting the numbers of the larger wolves, which have gradually become extinct over large areas in the eastern and middle parts of the United States where they were formerly abundant. Not so with the coyote. Except in a few thickly settled regions, it has thrived upon civilization and is practically as numerous as it was before settlements began. Indeed, in many parts of the West coyotes are said to be increasing in spite of a constant warfare against them.

The introduction of domestic birds and mammals has provided the coyotes with an additional food supply always available and entirely precluding any danger of starvation. Then, too, the animals are far too suspicious to be easily destroyed by the use of traps or poisons. Old hunters of the Plains have informed the writer that while it was comparatively easy to poison large numbers of the gray wolf, the coyote was not an easy victim and usually avoided both the baited traps and the poisoned buffalo carcasses.

The plains east of the Rocky Mountains and the higher plateaus of the Great Basin west of the mountains are especially adapted to the wants of the coyote. Cultivated areas are far apart; stock ranges are extensive; tall grasses, weeds, cactuses, and sagebrush afford excellent hiding places; rabbits, prairie dogs, ground squirrels, and other small animals are plentiful; and, when these natural resources of the country fail, sheep and young calves furnish abundant food.

In nearly all the Western States the efforts of ranchmen to destroy the coyote have been supplemented by laws authorizing the payment of bounties from public funds. Some of these laws have been in operation for a score of years or even more and, except locally, no diminution in the general numbers of the animals has resulted. In some parts of Mexico where the natives have for many years practiced systematic poisoning, the coyote is becoming rare, but in most sections of its range it is either increasing or no substantial decrease has been observed.

COYOTES IN KANSAS.

The State of Kansas, where settlements are comparatively old and where man's warfare against the coyote has been long continued, affords an excellent illustration of the animal's ability to maintain its numbers under seemingly adverse circumstances. Most of the counties of the State have for many years paid bounties for killing coyotes, and conditions have been reached where there is little fluctuation in the total amount paid from year to year. The returns of the animals killed for the fiscal twelve months from July 1, 1903, to June 30, 1904, show that nearly 20,000 scalps were presented for bounty in the State.

The following is a table, by counties, of the number of coyotes on which bounties were paid during the year above specified. Of the 11 missing counties, 10—Cherokee, Comanche, Finney, Grant, Haskell, Kearney, Morton, Seward, Stevens, and Wyandotte—paid no bounties, and 1, Doniphan, made no report. The bounty in all cases is $1 for each animal killed.

Number of coyotes on which bounties were paid in Kansas from July 1, 1903, to June 30, 1904.

County.	Number of coyotes.	County.	Number of coyotes.	County.	Number of coyotes.
Allen	73	Harper	44	Phillips	400
Anderson	129	Harvey	99	Pottawatomie	329
Atchison	48	Hodgeman	74	Pratt	242
Barber	633	Jackson	86	Rawlins	223
Barton	109	Jefferson	94	Reno	184
Bourbon	157	Jewell	106	Republic	52
Brown	70	Johnson	62	Rice	90
Butler	186	Kingman	257	Riley	206
Chase	343	Kiowa	477	Rooks	280
Chautauqua	451	Labette	137	Rush	144
Cheyenne	585	Lane	164	Russell	258
Clark	460	Leavenworth	56	Saline	186
Clay	104	Lincoln	105	Scott	193
Cloud	42	Linn	175	Sedgwick	223
Coffey	159	Logan	329	Shawnee	69
Cowley	325	Lyon	197	Sheridan	306
Crawford	51	Marion	166	Sherman	291
Decatur	240	Marshall	304	Smith	133
Dickinson	145	McPherson	210	Stafford	142
Douglas	99	Meade	224	Stanton	188
Edwards	290	Miami	96	Sumner	401
Elk	212	Mitchell	100	Thomas	185
Ellis	248	Montgomery	148	Trego	430
Ellsworth	193	Morris	176	Wabaunsee	170
Ford	500	Nemaha	58	Wallace	259
Franklin	152	Neosho	98	Washington	200
Geary	102	Ness	273	Wichita	307
Gove	355	Norton	227	Wilson	210
Graham	293	Osage	173	Woodson	115
Greeley[a]	117	Osborne	248	Total	19,514
Greenwood	336	Ottawa	61		
Hamilton	275	Pawnee	230		

[a] Six months.

The experience in Kansas is not exceptional. It may be duplicated in a dozen other Western States and in some of the British provinces. It is probable that the united efforts of the people are keeping the coyotes in check, and that, were these efforts relaxed, the animals would be far more abundant; but the coyotes are still so menacing to certain interests that the subject requires careful investigation to determine what more may be done to improve present conditions.

GENERAL HABITS OF COYOTES.

The various forms of the coyote seem each to conform to particular faunal areas. They inhabit all the life zones, from the Lower Boreal, through the Transition, the Upper and Lower Sonoran, and the semi-arid parts of the Tropical. In the northern part of its range

C. latrans has a migratory movement southward in winter and northward in the spring, probably caused by the limited food supply of the northern wilds, and varying in degree with the severity of the seasons. A similar movement of other species in the western part of the United States from the higher mountain areas to the valleys has been noticed. In summer the mountain species range above timber line.

The coyotes are noted for their peculiar prolonged howling. A single animal is capable of a performance which impresses the uninformed hearer as the concert of a dozen, and when several join in the medley the resulting noise is indescribable. They are silent during the day, but may be heard at any time between sunset and sunrise.

Coyotes breed but once a year. The mating season is late in January or early in February. The period of gestation is probably that of the whole genus *Canis*, which is given by Owen as about sixty-three days. The young are produced in dens, and number from four to eight or even more. The dens are usually enlarged from those made by badgers or smaller animals and are often among rocks or in washed-out places along banks of streams. Probably at times they are made entirely by the coyotes. They are rarely far below the surface, but sometimes of considerable extent and with two or more openings. Little attempt is made to provide nests for the young. In the Central West these are born early in April and usually may be heard in the dens during May. In June they come out to play around the mouths of the burrows, which are finally deserted during July. By August 1, the young are left by the parents to shift for themselves.

In the earlier descriptions, the prairie wolves were usually said to hunt in packs. Lewis and Clark, Say, Richardson, and others so reported, but the Prince of Wied met them only singly. It is probable that they hunt in numbers only when the quarry is large, as in the case of deer and antelope; but as many as three have been known to pursue a single jack rabbit.

FOOD HABITS OF COYOTES.

The food of coyotes has been a subject of investigation by the field naturalists of the Biological Survey, whenever opportunity offered. A number of stomach examinations have been made in the field; but trapped animals are often found with empty stomachs. In the case of a number of the species nothing definite is known of the food.

The stomachs examined contained mainly animal matter, but in two cases vegetable remains were found. One examined by Vernon Bailey contained a quantity of ripe cultivated plums; and William Lloyd found a coyote that had eaten mesquite beans. In northern

Arizona Doctor Merriam saw a coyote eating a watermelon, and a correspondent at Russell, Kans., says that they sometimes eat ripe melons. In California they eat peaches, apricots, grapes, and other fruits. They eat also juniper berries, manzanita berries, and the fruit of the prickly pear (*Opuntia*).

Only one case of insect-eating has been observed by the Biological Survey. The same animal that had eaten plums had in its stomach the remains of a large cricket (*Stenopelmatus fasciatus*).

Coyotes feed greedily upon all kinds of animal food. This ranges from the larger hoofed mammals to the smallest rodents, and includes also birds, reptiles, fish, and crustaceans. Three horned toads (*Phrynosoma*) were found in the stomach of a specimen killed June 3, 1898, in Big Smoky Valley, Nevada, by Vernon Bailey. On the low tropical coast of eastern Mexico and Texas members of the Biological Survey have often seen coyotes searching the beach for crabs, fish, and turtle eggs.

BENEFICIAL HABITS.

Among the mammals included in the food of the coyotes are many injurious species; and, so far as their food is confined to these, the animals are decidedly beneficial to the farming interests of the country. The destruction of rabbits, both large and small species, is of great advantage, especially on the plains and in the cultivated valleys, where their depredations are keenly felt by the settlers. The various species of jack rabbit have often been observed as included in the coyotes' fare, and the smaller rabbits are also habitually eaten. The coyotes usually catch the rabbits by lying in wait behind bushes and bunches of grass near their paths and pouncing upon them as they pass. Sometimes they have been known to hunt jack rabbits in company. While a single coyote would not be able to run down a jack rabbit, by hunting together, taking turns in the drive, and by taking advantage of the tendency of the hare to run in a circle, they are able to capture it. Eye witnesses to such a performance state that they do not fight over the division of the rabbit's carcass, but that all obtain a share. The constant warfare of many coyotes upon these rodents has much to do in keeping down the numbers; and the abundance of rabbits in some sections of the West has been largely attributed to a local decrease in the number of coyotes, caused by an unusual activity against them which had been stimulated by high bounties.

Prairie dogs (*Cynomys ludovicianus* and other species) are also a staple coyote food. The coyote captures them by hiding behind clumps of weeds or bunches of grass at some distance from the burrows. When the unsuspecting rodent, in feeding, approaches near enough, a few leaps enable the coyote to secure it. The grass in a prairie dog ‘ town ’ is usually cropped very short, and all tall-growing weeds are cut down. Sometimes a weed is permitted to grow to maturity on the cone-like mound at the mouth of a burrow. Only three species of weeds have been seen so growing by the writer—the horse nettle (*Solanum rostratum*), the Mexican poppy (*Argemone*), and a Euphorbia (*Euphorbia marginata*). These afford shade to the animals, but do not obstruct the view. All other weeds, and even cultivated crops, are cut down to prevent the unseen approach of an enemy. When the cultivated crop is some rapid-growing or dense one which they can not clear away, they abandon the land rather than stay to be devoured.

But clearing the prairie-dog town of weeds is not sufficient to baffle the coyote. In the absence of hiding places he takes to new methods of hunting. J. H. Gaut, of the Biological Survey, records his observations in a prairie-dog town in New Mexico:

> The coyote started at one end of the town and ran at lightning speed in a straight line until he cut off one from its burrow. When the prairie dog saw that it could not get to its hole, it stopped and began to kick until the coyote caught it and killed it in very much the same way that a dog kills a rat.

Besides rabbits and prairie dogs, the food of the coyote is known to include the following mammals:

Rice rats (*Oryzomys*), kangaroo.rats (*Dipodomys* and *Perodipus*), wood rats (*Neotoma*), ground squirrels (*Ammospermophilus*, *Callospermophilus*, and *Spermophilus*), woodchucks (*Marmota*), voles (*Microtus*), pocket gophers (*Thomomys*), chipmunks (*Eutamias*), and pocket mice (*Perognathus*). All of these are more or less harmful, and the coyote performs an important service in preying upon them. The service is not an occasional or a spasmodic one, but lasts throughout the year and throughout the life of the coyote. When the number of animals taking part in the work is considered, the enormous importance of its bearing in maintaining the ‘ balance of nature ’ becomes apparent.

The coyote is useful also as a scavenger. In the prairie country, especially in winter, it comes into towns at night searching for garbage thrown into the alleys. Here it finds remnants of meat from the table, offal from game, and similar prizes. When hungry it will reject no animal food, not even carrion. The slaughterhouses near the towns are favorite feeding places, and the animals are often shot there by moonlight. On the ranges they soon consume dead horses and cattle, leaving the bones clean.

INJURIOUS HABITS.

Coyotes have been known to capture some of the wild animals that assist man in his warfare against insects and rodent pests.

Among them are the weasels. In August, 1903, a member of the Biological Survey met a coyote carrying a weasel in the Pecos River Mountains of New Mexico at an altitude of 11,600 feet. The coyote, frightened, dropped its prey and ran off. The various kinds of skunks also are probably captured and eaten.

GAME DESTROYED BY COYOTES.

Coyotes destroy considerable game. Birds that roost and nest on the ground are frequent victims. Quail, grouse, and wild ducks are caught on the nest, and both birds and eggs are eaten. Wild ducks and geese, when wounded and unable to fly, may be found along the banks of streams and ponds, and the coyotes regularly patrol the shores in search of them. In Oklahoma I found fresh coyote tracks each morning on the grassy borders of a large artificial pond. Ducks resorted there in considerable flocks, and I several times found that they had been eaten by coyotes, as evidenced by tracks of the animals and feathers of the birds.

Like the larger wolves, the prairie wolf kills deer and antelope. In hunting these they always go in packs of two or more and take turns in the chase. They know that their prey runs in large circles, and at intervals individuals drop out of the pursuit and, crossing a chord of the circle, lie in wait until the quarry passes near them again. In this way the wolves keep fresh until the pursued animal is exhausted, but all of them are ‘ in at the death.’ The present scarcity of these large game animals gives few opportunities for such chases, but on the plains they were formerly of frequent occurrence.

DEPREDATIONS ON FARM ANIMALS.

The coyote is widely and unfavorably known as a destroyer of domestic animals. Its depredations upon these indicate a marked change of habit since the first settlement of the West. Previously its food was restricted to the wild animals, including young buffalo, antelope, and deer. The destruction of the larger game by man may partly account for the change to farm animals as a diet, but it is probable that the quality of the introduced food had much to do with the coyote’s preference for it.

The coyote kills hens, ducks, geese, and turkeys. Its usual method of capturing them in daytime is to lurk behind weeds or bushes until the fowls come within reach. Turkeys, which range far afield in search of grasshoppers and other insects, are frequent victims. At night the coyote captures poultry from the roost, provided the door of the henhouse is left open. A correspondent of the Biological Survey wrote from Rexburg, Idaho, that one neighbor had lost 60 chickens and another 30 in one night, taken by coyotes. Another correspondent, in Mayer, Ariz., writes:

> Have lost about 100 chickens by coyotes. With the exception of killing chickens, I believe them to be beneficial in keeping down the rabbit pest.

In approaching ranch buildings either by day or by night the coyote comes from the leeward side and with great caution. Once satisfied that no danger lurks in the shadows, it becomes exceedingly bold. George A. Coleman, formerly a member of the Biological Survey, wrote from London, Nemaha County, Nebr.:

> Depredations by wolves here upon henroosts and pigpens are of frequent occurrence. I have observed them several times. They come with a dash into the yard, take a chicken by the neck, and are gone before anyone can stop them. In the same way they visit the pigpens and take the young pigs away from the mother. In one instance they made way with eight 6-weeks-old pigs in one night. At another time two of them attacked a pig which would have weighed 75 pounds, and had they not been stopped by dogs would probably have killed it.

Few of the mammals of the farm are exempt from coyote raids. Even house cats, roaming far from home in search of rodents or birds, become victims. A correspondent of Forest and Stream, writing from Shirley Basin, Wyo., October 7, 1896, says:

> I live on a ranch, and we are somewhat troubled by field mice and mountain rats, and so we must keep cats. We have them, but we do not keep them long, because they are caught by coyotes. Within a few months I have lost four cats in this way.

The coyote has been known to kill the young of most farm animals—colts, calves, pigs, lambs, and goats. Colts are seldom killed, because the dam can usually protect them. Calves are taken only when the mother cow is feeding at a distance or has gone for water. The coyotes lie watching in the grass until this opportunity comes. Sometimes older animals are killed. Ranchmen in Oklahoma told the writer that in winter yearling cattle in good condition are sometimes killed by coyotes. To accomplish this two or more of them must hunt together, and get the victim separated from the herd.

Capt. P. M. Thorne, writing to the Biological Survey from Fort Lyon, Colo., January 4, 1887, says:

> Old cattlemen who have lived here nearly all their lives agree in saying that the coyotes kill cattle, even full-grown ones. They say that they have seen them at their work, which is done in packs; they surround an animal and keep up a constant nipping at its legs until it falls from weakness and loss of blood.

In July, 1893, at Farmington, Utah, Vernon Bailey saw two coyotes chasing calves and yearlings about a pasture, evidently trying to separate one from the lot. He notes that in June, 1889, at St. Thomas, Nev., coyotes killed a hog that weighed about 100 pounds.

THE COYOTE'S RELATION TO THE SHEEP INDUSTRY.

The coyote is especially notorious as an enemy of the sheep industry. In many parts of the West sheep raising has greatly languished because of the depredations of wild animals upon the flocks. While some of the injury is caused by the larger wolves, mountain lions, bears, and lynxes, the coyotes are by far the most formidable enemy. They are not only more abundant than the other animals mentioned, but they are present throughout the year, and their depredations are a steady drain upon the resources of the flock owner, comparable in extent to the losses caused by worthless dogs in many parts of the country.[a]

Dr. E. A. C. Foster, writing from Russell, Kans., in 1887, said:

> Of mammals, the prairie wolf is perhaps the most troublesome. It is constantly preying upon sheep and lambs; so much so that sheep can not be left alone without some of them falling a prey to this animal. Should the herder be absent or out of view, the wolf makes a dash into the flock and usually secures a lamb.

William Lloyd, writing from Paint Rock, Concho County, Tex., said:

> In January, 1886, coyotes killed over 30 sheep near Fort Stockton, and in March about 20 at Toyah, Tex.

Charles W. Richmond, in 1888, wrote to the Survey from Gallatin County, Mont., relating the following incident:

> While we were camped near Bozeman a flock of some 4,000 sheep were driven by, and night overtook them on some foothills south of Bozeman. During the night a flock of coyotes entered the ranks and the sheep stampeded. Many ran over some bluffs, and next morning sheep, dead and dying, were several feet deep at the foot of the bluffs. Nearly 500 were counted in the pile, and for several days afterwards sheep, with lacerated ears and torn flanks, wandered into barnyards in the vicinity. The total number lost must have been heavy.

In parts of the Southwest sheep growers have estimated their losses from wild animals as equal to 20 percent of the flock. The average loss reported from several States is 5 percent. In nearly all the States west of the Mississippi the industry has declined in the past two years, and one of the principal causes given is losses from coyotes. At present the industry thrives only in sections where the local conditions permit the herding of sheep in large flocks—a system highly injurious to the pasturage.

It is evident that the wealth of any State could be materially increased if it were possible everywhere to keep small flocks of sheep. Flocks increase rapidly under favorable conditions and good management, and the cost of keeping them is small when herders can be dispensed with. The double product, wool and mutton, usually places the profit of handling them above that of cattle or horses. The gains also come oftener, since sheep mature in a year, while cattle and horses require three.

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[a] In 1891 the loss from dogs was placed at $152,034 in Ohio and $200,000 in Missouri. (Sheep Industry in the United States, U. S. Dept. of Agric., 1892.)

Vernon Bailey, chief field naturalist of the Biological Survey, writing from Seguin, Tex., under date of November 8, 1904, says:

> No sheep are kept in this part of Texas, and in talking with several intelligent farmers I find that the reason invariably given is the abundance of coyotes. The region is occupied by small farms, mainly 80 to 500 acres, on which cotton, corn, sorghum, and vegetables are the principal crops. There are few if any large stock ranches, but each farm has its pastures for horses and cattle. These pastures are the wild land covered with scattered mesquite, post oak, and patches of chaparral and cactus. The native grasses are abundant and of excellent quality, and in this mild climate furnish good feed throughout the year. Many of the pastures are not half eaten down, and the dead and dry vegetation becomes a nuisance. After harvest cattle and horses are usually turned into cotton and grain fields, where they do good work in cleaning up grass and weeds in the field and along the borders. Still there is abundance of feed constantly going to waste, and a small flock of sheep could be kept with great profit and no expense on almost every farm.
>
> Fifty to two hundred sheep on a farm would at once make this part of Texas the most important woolgrowing section of the State. Other advantages to be gained would be keeping down the cactus and chaparral, which are inclined to spread and occupy much of the ground, keeping the edges of pastures and fields cleaned up so that they would not harbor a host of predaceous insects and rodents in close proximity to growing crops, and furnishing to the farmers and small towns a supply of fresh meat other than chicken. In this warm climate beef is rarely available, except in the larger towns. The advantages of introducing sheep into this part of the country are acknowledged by the farmers, and there seems to be no reason why it has not been done, except that coyotes are common, large, and fond of mutton.

Similar conditions prevail in many parts of the West and over large areas. While a dozen years ago the low price of wool was an important factor in causing farmers to abandon sheep raising, in recent years the prices have been excellent. Fine washed wool was quoted in the New York market February 6, 1905, at 32.35 cents per pound and in St. Louis on the same date at 40.41 cents per pound. The price of tub-washed wool at St. Louis was at no time during 1904 less than 30 cents per pound. Unwashed wool ranged from 15 to 31 cents during most of the year. Yet the number of sheep in the United States is now decreasing. Montana, with an area of 146,000 square miles, leads the States in the number of sheep kept, which is 5,638,957.[a] England, with an area of 50,867 square miles, has about five times as many as Montana. In Montana sheep are herded in immense flocks; in England every landowner and farmer keeps a small flock.

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[a] Crop Reporter, U. S. Dept. Agric., February, 1905.

It is evident that the discouraging condition of the sheep industry in the United States is not due to a lack of favorable climate nor to the absence of suitable pasturage. Neither is it due to low prices of wool and mutton. Indeed, in our markets mutton is coming to be more and more in favor, and this growing demand may be one of the causes for the present drain upon the flocks and the decrease in their numbers; but the chief discouragement of the industry undoubtedly lies in the depredations of worthless dogs and coyotes.

The dog question is a serious one, especially in thickly settled parts of the country, but the evil is best remedied by a resort to taxation. The tax on dogs should be sufficiently high to put most of the worthless ones out of existence.

MEANS OF DESTRUCTION.

The coyote problem is a serious one. Various methods of dealing with it have been in vogue since coyotes first began to like mutton. None of the methods have been entirely satisfactory, and some are signal failures. All of them combined have resulted in a partial check on the increase of coyotes in most parts of their range. Poison has probably killed the greatest number of adult animals, and in some parts of Mexico has almost destroyed some of the species, but no such success has attended its use in the United States.

POISONING.

Strychnine has always been a favorite weapon of hunters for wolf pelts and bounties. A half century ago hunters on the prairies killed the buffalo for its pelt, and added to their income by killing the wolves that followed the daily slaughter. A little strychnine inserted in the skinned carcass of a buffalo enabled them to secure many pelts of the gray wolf and occasionally one of the coyote; but not often the latter: he was regarded as much too shrewd to be taken by ordinary methods of poisoning. Besides, the pelt was small and not sufficiently valuable in comparison to warrant special efforts to secure it. Even in 1819 Thomas Say, who first gave a scientific name to a coyote, found this animal more abundant than the gray wolf.[a] Yet the number killed for their pelts has never been great.

As an illustration of the coyote's shrewdness in avoiding poisoned baits, a farmer in Oklahoma gave the writer the following experience: After butchering some hogs he poisoned a hogskin and left it with other offal for a coyote that nightly prowled about his premises. In the morning everything but the poisoned skin had been cleared away. He left it two more nights, but it remained untouched. Thinking that the animal would not eat the poisoned bait, he buried it. That night the coyote dug up the pigskin and ate it, falling a victim to its deadly contents. Since then the farmer says he has never failed to poison coyotes when he buries the bait.

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[a] Long's Expedition to the Rocky Mountains, p. 168, 1823.

Another method of poisoning coyotes is to insert the strychnine in small chunks of meat that can be easily swallowed. Success by this method depends largely upon the condition of the animal as regards hunger, and may be helped by making what is known as a 'drag' in the neighborhood of the bait. A small animal—a bleeding dead rabbit is good—is dragged over the prairie and the morsels of bait left at intervals along the 'drag.' Two days previous to a general coyote hunt in Oklahoma a steer badly affected by 'lumpy jaw' was killed, opened, and left in the middle of the area to be hunted. During the first night coyotes howled all night in the vicinity of the carcass, but failed to touch it. The second day a hind quarter was separated from the carcass and dragged in a circuit of a mile or two, the drag coming back to the carcass. During the following night the coyotes picked the bones of the carcass bare. Thus gorged with beef, they were in a condition favorable for their slaughter in the drive of the following day.

In the use of strychnine for wolves, the dry crystals of strychnia sulphate are generally preferred. They should be inserted in the bait with a knife blade, and the meat should be handled as little as possible. It should be remembered that if precautions are not taken there is a greater probability of killing dogs than wolves. The entire neighborhood should know of the intended attempt, and all valuable dogs should be confined until the operation is finished and uneaten baits disposed of.

TRAPPING.

Coyotes are not easily trapped. Some skill and a good knowledge of their habits are requisites for success. They travel in rather well-defined paths and usually hunt against the wind. Having a keen sense of smell, they easily detect the tracks of man, and if they have had previous experience of traps or guns they are suspicious of danger. In the wildest parts of the country remote from settlement they are more readily trapped. The chances for successful trapping decrease with their familiarity with man, so that there is little probability that the process will ever have much effect on their numbers.

The writer knows a Kansas trapper who is quite successful in capturing coyotes in a rather thickly settled part of that State. He uses steel traps and sets them along hedges in places where the animals are accustomed to pass through openings. No bait is used and the trap is partly concealed by dead leaves or grasses. He claims that both the direction of the wind and of the animal as it approaches the opening have much to do with the chance for success.

Field naturalists of the Biological Survey usually have experienced little difficulty in securing coyotes in traps. A No. 3 steel trap is generally used. A suitable place is selected along a narrow path or trail and the trap sunk in the ground level with the surface and concealed with fine grass, leaves, or other material that will harmonize with the surroundings. At the same time care is taken that the material used shall leave the jaws of the trap free to spring clear of the covering.

The trap should be fastened to a bush or stake, or if these are not available, to a clog. For the last a pole lying on the ground is best, since it may be utilized without moving it or disturbing the surroundings. If the trap is anchored to a bush or small tree the chain must be securely fastened with snap or wire. A stout stake over which the ring will not slip, driven out of sight into the ground, is better. Every part of the trap and chain is covered, and the ground left in as natural and undisturbed condition as possible.

Any kind of fresh meat will do for bait—rabbits and other small rodents are often used, but larger baits seem to be more attractive. It is also of advantage after setting the trap to make a 'drag' of the bait for a quarter to a half mile, at the end of a rope from the saddle horn, and finally to fasten it to a bush or stake close to the trap, or cut it in bits and scatter all around the trap so that not all can be reached by the coyote without walking over the trap. The skill of the trapper and the situation of the trap will determine the best arrangement. The suspicion of the coyote is lessened apparently after following the bloody trail of a well-planned drag.

Before setting the traps many trappers rub their feet and hands on a skin or some strong-smelling meat or carcass to conceal the human odor. Oil of anise or rhodium is sometimes used for the same purpose. Any strong odor is likely to attract the attention of the coyote and allay suspicion. Care must be taken not to spit on the ground or kneel or throw down any clothing in the vicinity of the trap. A good plan is to set a line of traps and leave them for a day or two, and then go the rounds with a horse and drag, and bait the traps without dismounting.

HUNTING.

Many ranchmen find dogs an efficient help in guarding against coyote depredations. For this purpose the small varieties are useless, since the coyotes do not fear them. Beagles and larger foxhounds are too slow. Staghounds, Russian wolfhounds, greyhounds, and their crosses are to be preferred; and at least three are needed to successfully chase and safely kill a coyote. These dogs soon learn to hunt wolves, and are seldom known to harm sheep. Ranches on which they are kept are comparatively free from depredations of wild animals, while others within a few miles are by no means exempt. Of course, the keeping of these dogs on small farms would hardly be practicable.

In the open country where there are few fences, hunting the coyote with horse and dogs is an exciting sport. Fox chasing, although less meritorious in purpose, may have some advantages as sport, because the quarry is not always in sight and the skill of the hounds is pitted against the cunning of the fox. In the chase of the wolf, as in coursing hares, the race is straight away and without cover; and when the quarry is overtaken the fight is won only because of the overpowering numbers of the pursuers. The ordinary greyhound can easily overtake a coyote, but is usually unable to kill it alone.

Coyote drives, in which an entire community engage, have become a popular feature of rural sport in some parts of the country. Such drives have been held in Kansas, Colorado, Idaho, Oklahoma, and Texas; but the methods employed depend largely on the local topography. The writer was present at the second annual wolf hunt which took place November 24, 1904, in the large Pasture Reserve near Chattanooga, Okla.

On Thanksgiving morning the weather was perfect, and a large number of people from the surrounding country collected in the village of Chattanooga. A little before noon the men who were to drive the wolves rode out of town and headed for their positions in the Pasture. As there were less than 150 men, the area covered by the drive was not so large as had been planned. The drivers were separated into three divisions. The south division, which was under the immediate charge of the commander of the hunt, Mr. J. W. Williams, proceeded about 7 miles south of Chattanooga. The eastern and the western divisions were under the charge of other captains and had their stations about 4 miles to the southeast and southwest of the town. The area covered by the drive was somewhat over 6 miles square.

On the north side were the spectators, occupying a position about a mile and a half from the town and extending over nearly 2 miles of front, from which the land sloped gently to the south. The spectators came from town in every sort of farm vehicle and numbered fully 500.

In front of the line of vehicles some 50 men on horseback held in reserve nearly 100 dogs, mostly greyhounds. Guns of all kinds were ruled out of the final 'round-up,' and only lariats, dogs, and clubs were permitted as weapons.

The line of spectators was formed at 1 o'clock, but it was fully an hour before the driving divisions were heard or seen. In the south a beautiful mirage occupied the distant valley—a white sheet of water bordered by trees. It was on the surface of this mimic lake that we first saw the riders galloping by twos. Soon after we faintly heard their distant shouts; and when the shouts began to come clearer, the coyotes also came up the valley by ones and twos, and at length by threes and fours before the swiftly moving horsemen.

When the first wolf was still a half mile distant, the dogs were released and riders and dogs dashed to the front to head off the animals. Hemmed in in front and rear, they broke to the right and to the left, and many made good their escape through the thinner lines of the east and the west divisions.

The sport was fast and furious for a short time, but when a little later the dead and captured wolves were brought together in the town, they were found to number only eleven in all. Two of them were roped by cowboys during the drive and killed with pistols. Two were dragged to death at the end of lariats. Seven were caught by the dogs in the round-up, and two of these were brought in alive. Many escaped, but it is impossible to estimate the number.

Such hunts have considerable influence in decreasing the number of coyotes and also afford an agreeable break in the monotony of frontier life. Their purpose, however, is never admitted to be that of sport, but to kill coyotes.

BOUNTIES.

Activity in the warfare against the coyote has been considerably stimulated by the payment of bounties from the public treasury of the States and counties. Nearly all the States in which coyotes occur have been for years maintaining such bounty systems. In some parts of the West these are supplemented by rewards from stock associations or ranch owners. The bounties from public funds have ranged from 25 cents to $5 for each animal killed, but supplementary payments sometimes make them as high as $15.

The subject of bounties in general has been already discussed by Dr. T. S. Palmer, of the Biological Survey.[a] Doctor Palmer refers to the California coyote act of 1891, which was practically in force only eighteen months, but which cost the State $187,485. As the bounty was $5 per scalp, this represented the destruction of 37,493 coyotes. Kansas, with a county bounty of $1 per animal, succeeds in destroying about 20,000 each year. In addition to the bounty, the pelt of an adult coyote is worth from 50 cents to $1.50, according to its condition. However, most of the killing is accomplished in spring, when the female and her young are dug out of dens and the pelage of the adults is not in prime condition.

Doctor Palmer rightly concludes that in practice bounties for the destruction of noxious animals, paid from public funds, are usually objectionable. Probably those on wolves and coyotes have been more nearly justified than those on any other animals. While it is certain that the larger wolves have greatly diminished in numbers under the system, forces far more potent than mere rewards have operated against them. Chief of these has been the encroachment of civilization. Coyotes have in some places held their ground under bounties, and possibly might have been held in check nearly as well under the operation of the same forces that helped to decimate the timber wolves. But the observed effect on the coyote of contact with settlements hardly justifies such a conclusion. That the bounties in some places have done effective work is undoubted; the question is as to whether the results have been commensurate with the expenditures. However, the principal objection to bounties is the ethical one, that they lead to fraudulent practices.

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[a] Extermination of Noxious Animals by Bounties. Yearbook U. S. Dept. of Agr., 1896, pp. 55–68.

PROTECTION AGAINST COYOTES.

The discussion of the various means of destroying coyotes, and the evident futility, thus far, of all of them combined to completely check the increase of the species, leads naturally to the consideration of means of preventing their depredations. Could domestic animals be entirely protected, the coyotes would return to their original beneficial occupation as scavengers and destroyers of noxious rodents.

The plan that at once suggests itself is that of fencing against them. This means of protection from wild animals has been long in vogue in the Australian colonies and in South Africa. In Australia rabbits, dingoes, and some species of kangaroos are successfully kept out of pastures and crops by the use of wire nettings. In Cape Colony jackals, particularly the red jackal (*Canis mesomelas*), are a great hindrance to sheep and ostrich farming, and the success attending the use of wire netting in Australia led to the introduction of similar fencing into South Africa. The result has been highly gratifying. While the cost of the fencing is high, the advantages from its use have been regarded as more than compensating for the outlay. Mr. T. T. Hoole, president of the Upper Albany (Cape Colony) Farmers' Association, in a paper read at a meeting of that society[a] gives details of ten years' experience with jackal-proof fencing. Among its advantages to sheep growers he names:

1. Decreased cost of herding.
2. Increased value of the wool, about 3 cents per pound.
3. Increased number of lambs reared.
4. Increased value, owing to early maturity and condition of stock.
5. Less liability to contagion from scab.
6. Reduced death rate.
7. Additional security of the flock.
8. Improved condition of pasturage as against deterioration.

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[a] Agr. Jour. Cape of Good Hope, vol. 25, pp. 560–563, 1904.

The last item alone he regards as more than repaying the entire cost of erection. Under the system of herding on the open veldt it becomes necessary to protect from wild animals by driving the sheep to a kraal for the night. In the vicinity of the kraal the ground is soon trodden bare, and deep parallel paths are worn in the surface. In a few years the torrential rains wash the paths into what are called 'sluits'—similar to the 'arroyos' of our own Southwest.

In the western part of the United States the practice of keeping sheep in vast herds has resulted in much deterioration of the ranges, due to overcrowding, and the cost of herding has absorbed much of the profits of sheep raising. The process of withdrawing lands for homesteads and the various reservations has diminished the free range and increased the crowding, until flock owners for their own protection have been compelled to purchase lands for range purposes. The day of free pasturage on public lands is fast passing, and with private ownership of ranges, fencing must be resorted to to confine the flocks. The additional expenditure necessary to make the fences proof against coyotes would be inconsiderable when all the advantages are properly weighed.

INVESTIGATIONS CONCERNING COYOTE-PROOF FENCING.

The Biological Survey has undertaken an investigation of the feasibility of successfully fencing against the coyote. If a coyote-proof fence of sufficient cheapness and durability to be practicable can be brought into general use for pasturage, there is no reason why the sheep industry in the West should not be revived and greatly extended. If such a fence should at the same time prove efficient against dogs, the benefit would extend to the whole country and result in an enormous increase of the productive resources of our farms. A coyote-proof fence would prove valuable, even if its use were restricted to corrals and small pastures for ewes during the lambing season.

The writer, under instruction from the Chief of the Biological Survey, spent several weeks in the field during October and November, 1904, making such investigations as were possible during the limited time at his disposal. For the purpose of testing the ability of coyotes to pass over or through fences a unique experiment was made. The place selected was Chattanooga, Comanche County, Okla. South of the town lies the great Pasture Reserve, a large area practically without fences to interfere with the chasing of wolves. Since coyotes were abundant and the cowboys skilled in their chase, it was not difficult to procure the needed animals in an uninjured condition.

The experiment was made with all the forms of fence that could possibly be obtained or built with the limited resources of a new country. A long lane was first built, with sides 7 feet high, made with poultry netting of a small mesh. Fourteen cross fences of heights from 30 to 66 inches and of various designs were built at intervals along the lane. They were arranged so that the coyotes, introduced at one end of the lane, should have presented to them gradually increasing difficulty in passing the fences. Two coyotes were released singly into the lane, and their progress and methods of passing the cross fences were carefully noted. One was badly frightened by the presence and noise of dogs and men, but the experiment with the other was not made in public.

The coyotes ran with their noses close to the ground and seemed to have no knowledge of jumping. Neither of them succeeded in getting over a fence more than 36 inches in height. The method was one of climbing, assisted by the hind feet, rather than of jumping. All attempts to pass the obstructions began with efforts to get the muzzle through openings. If the entire head could be thrust through and there was enough room for the shoulders to spread out laterally, the whole wolf was able to follow. Both went through rectangular openings, 5 by 12 inches and 5 by 8 inches, but the larger animal failed to pass a mesh 5 by 6 inches. The smaller animal went through an opening 4 by 12 inches and another 5 by 6 inches. Had these openings been triangular in form the animal could not have passed through.

The following conclusions were drawn from the experiments:

1. Prairie coyotes will not willingly jump over a fence above 30 inches in height.

2. They will readily climb over fences built of horizontal rails or crossbars, especially in order to escape from captivity.

3. Barbed wires do not deter them from crawling through a fence to escape. Whether they would go through a closely built barbed-wire fence to attack sheep or poultry is still an open question.

4. Woven-wire fences should have meshes, when rectangular, less than 6 by 6 inches to keep out coyotes. For such fences triangular meshes are much better than square ones.

5. In fencing against coyotes with woven fences care must be used to see that there are no openings at the ground through which the animals can force themselves, since they are more likely to crawl under a fence than jump over it.

In the experiments the animals, under some excitement, were attempting to escape from confinement. In the judgment of the writer, the experiments are insufficient to determine what a coyote would do if the conditions were reversed and, impelled only by the stimulus of hunger, he were attempting to enter an inclosure built of these fences. The barriers would surely be far more formidable. Experiments with certain types of fence, with sheep inclosed within them, and in a country with wolves as plentiful as they are at Chattanooga, would be far more conclusive in establishing a safe basis for practical recommendations to farmers.

The writer interviewed a number of farmers in Kansas who have had experience with poultry and farm animals in coyote-infested country. Several of them had for some years been using for corrals and small pastures woven-wire fences, and had found those from 57 to 60 inches high entirely coyote-proof. These fences have triangular meshes and are of sufficient weight to be suitable for all kinds of stock. Such a fence, if set with the lower edge on the ground and anchored down where necessary, can safely be recommended as coyote-proof. Their cost, however, is possibly too great to bring them into general use for sheep pastures. Where land is valuable and pastures of the best, they will prove economical, for they have the merit of being both dog-proof and coyote-proof. Dogs, both large and small, that by chance get inside the inclosures are unable to get out, and have to be let out by the gate.

Between these rather expensive fences and the cheapest form that may be found efficient many grades may exist. In experiments to determine the efficiency of any form it is necessary to consider the familiarity of the animals with fences in general. In a new country a very simple fence might be ample at first to keep out wolves, but ultimately would prove insufficient.

Mr. T. T. Hoole, of Cape Colony, Africa, in the paper already quoted, gives the following experience in determining upon a jackal-proof fence:

> My first importation of 2 foot 6 inch netting served its purpose for a year or more, when I found the jackals as troublesome as ever. The addition of a single barbed wire assisted for a time; but after some years of experience and comparing notes, I found that nothing short of a 3-foot netting and four barbed wires would be effective. I have given the above particulars of my experience as a warning to the inexperienced, that half measures are simply a waste of money and that badly erected fences, although effective for a time, will end in disappointment and failure.

Mr. Hoole has 18 miles of the fence just described, while a neighboring stockman has 45 miles built. The cost, including labor, when built of the best material—sneezewood posts and kangaroo netting—was estimated at £106 per mile—about $500. This fence was designed for ostriches, cattle, springboks, and sheep; a fence intended for sheep alone could be built for less. Materials and labor are both much more expensive than in the United States. A fence similar to that described by Mr. Hoole could be built in most parts of the West for about $200 to $250 per mile.

A writer in the Nor' West Farmer states that when he first began sheep raising in Manitoba a 2-strand barbed-wire fence was a complete barrier to the coyotes, but that in less than two years they became used to it and would go under or between the wires without hesitation. More strands were added without effect, until a woven-wire fence was adopted, which proved satisfactory.

In South Africa three types of fence have been in use for protection against jackals, and each has advocates among the farmers. The cheapest is built of strands of barbed wire placed close together and stayed at intervals by light strips of wood fastened to the wires by staples. In the second form the staying is done by light, smooth wire woven in by machinery, involving more labor in the building. The third type is that recommended by Mr. Hoole. It is more expensive, but seems always to have stood the test of experience. The others have not always been satisfactory, but their advocates claim that the fault has been in construction and not in design. The jackals have entered the inclosures through openings at the ground.

Mr. J. H. Clarke, of Laytonville, Mendocino County, Cal., has for several years succeeded in fencing coyotes from his sheep range. In a letter to the Chief of the Biological Survey, dated March 4, 1905, he describes the fence and relates his experience:

> The fence, inclosing nearly 4,000 acres, consists of redwood pickets 6 feet long driven into the ground 1 foot and leaving spaces or cracks not over 4 inches wide; posts 8 feet long and driven 2 feet, projecting 1 foot above the pickets; two barbed wires stapled to the posts 5 inches above the pickets and the same distance apart. These should be on the outside of the posts. The pickets are driven evenly by using a slat as a guide at the bottom and a line at the top. One barbed wire is placed at the bottom on the outside to prevent digging. The pickets are fastened to a No. 9 cable wire with a No. 13 wrapping wire. The posts are set 12 feet apart, or less, according to the surface—at top and bottom of each rise or indentation.
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> Where gulches or small streams are crossed boxes and gates are put in. Where larger streams are encountered a dam is first put in and the gate so swung as to rest on or against the dam head in the dry season.
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> The cost of construction varied from $320 to $400 per mile. Galvanized wire was used, and of the barbed the thickest-set four-pointed wire obtainable. If four-point wire could be had, with sharp points set not over 2 inches apart, the top wire might be dispensed with.
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> While this fence was begun in 1897, it was not finished until three years ago. It was partly experimental at first, and at the end of the second year only that portion of the range used for lambing was inclosed with a coyote-proof fence. We do not know that a coyote has ever scaled or jumped it. A very large coyote that got in through an accidentally 'propped' floodgate, though chased by dogs all day, could not be made to jump out, even when cornered. Considering the steep, wild, and broken nature of the country, with several 'slides' in the fence that could not be avoided when building, and which move and displace the fence during hard storms, it is not surprising that a few coyotes have gotten in. Fortunately, partition fences have aided in the capture of these before much damage was done. Two obstacles are encountered in keeping up this fence—trespassers, who cut or break a picket to get through, and slides.
>
> Coyotes are very persistent, and when they see young lambs on the opposite side will follow the fence for miles, trying to find a hole. * * * None have gotten in this season.

> When we began to fence against them the coyotes were literally driving sheep out of the country. * * * Horses and cattle have taken their places, but return less than half the profit sheep did prior to the coyote's inroads. Excessive rains in winter and irregularity of landscape preclude the practicability of close herding. With us it was either abandon sheep or fence the pest out. Fortunately we adopted the latter.

While the fence used by Mr. Clarke is expensive, the complete success of his experiment is of much interest. In most parts of the West woven wire would be cheaper than pickets and would require less labor in its erection. Where the land is as uneven as that just described, the use of woven wire may be impracticable.

Mr. D. W. Hilderbrand, of California, who has built coyote fences for ranchmen in the San Joaquin Valley, recommends a 3-inch mesh woven wire fence 36 to 40 inches in height, with two barbed wires on top, 5½ inches apart, and one at the bottom. He recommends that the posts be set 20 to 30 feet apart.

From data now available it seems reasonably certain that a fence constructed of woven wire with a triangular mesh not over 6 inches across, and of a height of 28 to 42 inches, supplemented by two or three tightly stretched barbed wires, would prove to be coyote-proof. It is difficult to make exact estimates of the cost. Woven fences differ in weight, price, and durability, and freight charges on materials depend on the distance from distributing points. The cost of posts and labor varies much. An estimate based on so many variable factors is of little value, but an average of $200 per mile would probably allow the use of the best materials.

Further experiments with wire fences will be made by the Biological Survey in cooperation with sheep growers in the West, and the results will be given to the public as early as practicable. The matter is one of great economic importance, and the Survey will welcome correspondence with persons interested in the subject.

O

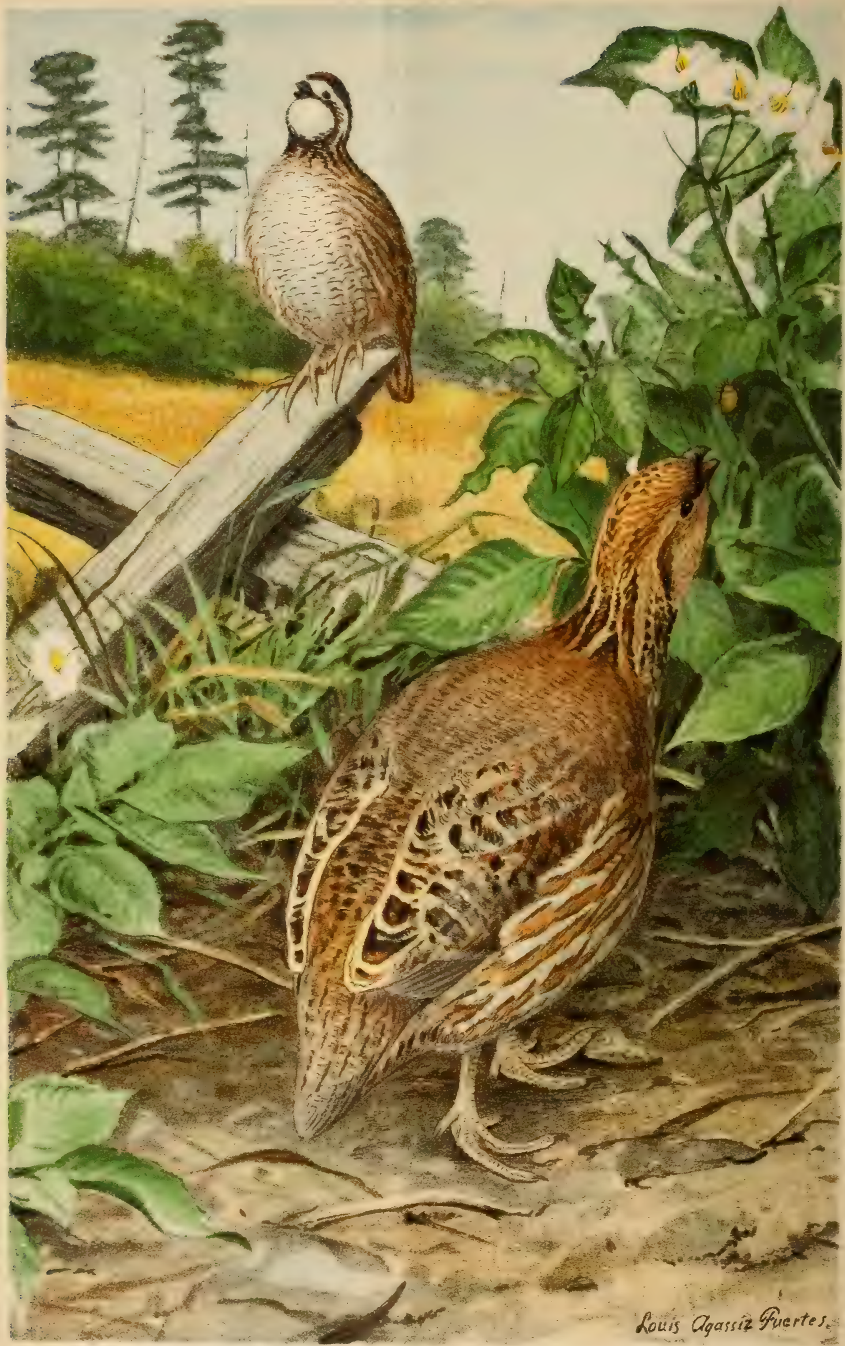
U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF BIOLOGICAL SURVEY—BULLETIN No. 21
C. HART MERRIAM, Chief

THE BOBWHITE AND OTHER QUAILS OF THE UNITED STATES IN THEIR ECONOMIC RELATIONS

BY

SYLVESTER D. JUDD
Assistant, Biological Survey

WASHINGTON
GOVERNMENT PRINTING OFFICE
1905


Louis Agassiz Fuertes.

A. HOEN & CO. BALTIMORE.

BOBWHITE IN POTATO FIELD.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., July 31, 1905.

Sir: I have the honor to transmit herewith, for publication as Bulletin 21 of the Biological Survey, a report on the quails of the United States and their economic value, by Sylvester D. Judd. The quails as a group are perhaps better known through the country than any other birds. From the time of the first settlements in New England and Virginia till the present day they have been favorite objects of pursuit by sportsmen, and are widely known as table delicacies.

The chief purpose of the present paper is to consider the quails in their economic relations to the farmer—relations not so well understood as they deserve to be. Investigation shows the birds to be no less important in their economic than in their other relations to man. They are found to be exceedingly valuable allies of agriculture because of the quantity of noxious insects and weed seeds they destroy, while the harm they do is insignificant.

I am indebted to my assistant, E. W. Nelson, for preparing the introduction and critically reading the text, and to the Bureau of Entomology for the identification of many of the insects mentioned.

Respectfully,

C. Hart Merriam,
Chief Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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THE BOBWHITE AND OTHER QUAILS OF THE UNITED STATES IN THEIR ECONOMIC RELATIONS.

INTRODUCTION.

The quails of the United States, because of their interesting habits and marvelous diversity of form and color, are a notably attractive group. All are handsome birds, but the most striking and beautiful species live in the Southwest and on the Pacific coast. Seven species occur within our borders, but only one in the Eastern States. The others are widely distributed from Texas to California and Oregon. Their range was, and still is, continuous along the entire southern border of the country from the Atlantic to the Pacific; but there is an irregular belt along the northern border and a large area in the interior, comprising the Great Plains, the northern three-fourths of the Great Basin, and the Rocky Mountains, in which they appear to have been originally wanting.

With few exceptions our quails welcome the extension of agriculture, and the added food supply in farmed areas results in an increase of their numbers. This is equally true of the bobwhite of the East, and of some of the desert species of the West. So fully does the bobwhite appreciate the advantages of the farm that its range has increased with the extension of the cultivated area, especially west of the Mississippi.

The quails, because of their cheerful habits, their beauty, and their value as food, are usually welcome on the farm; but their real value to agriculture is not yet generally understood. The investigations of the Biological Survey show that these birds, with rare exceptions, are not only harmless, but that usually they are very useful to agriculture. This is particularly true of the bobwhite, which constantly feeds on injurious weed seeds and insects, and thus renders valuable service to the farmer. In return for this good service it is but fair that these birds should be treated with friendly care and interest.

The well-known bobwhite is the only quail indigenous to the Eastern United States, where it ranges from southern New England to Florida and Texas; but owing to climatic influences the birds of Florida and of Texas differ enough to be distinguished as geographic races. Wherever it occurs, however, the bobwhite has the same call, and varies but little in habits. A closely related bird, the masked bobwhite, inhabited southern Arizona until within a few years. Owing to dry seasons and the overstocking of its home with cattle, this bird is now supposed to be extinct within our borders; but some probably exist in parts of Sonora, Mexico.

Although bobwhites are handsome birds, yet they are the plainest quail in the United States except the ‘cotton top’ or scaled quail of the deserts of southern Texas and Arizona. The latter is slaty bluish on the upper parts, which are ornamented with large scale-like markings, and has a whitish crest.

The most bizarre and curious of all is the Mearns quail of the high, broken plains and mountain slopes of southwestern Texas, southern New Mexico and Arizona. It is short and round bodied, like a little guinea hen, and this superficial likeness is increased by brilliant round white spots ornamenting the dark sides. It is the gentlest of all the quails and is so unsuspicious that when a person encounters one it often walks unconcernedly about or stands looking curiously at the newcomer, when it is not infrequently killed with a stick or stone, a characteristic which, among the people where it lives, has earned for it the name of ‘Fool Quail.’

The Gambel quail is a habitant of the southwestern desert region, where it ranges the brushy foothills and the valleys along water-courses. It is a beautiful bird, the head handsomely marked and adorned with a jet-black recurving crest, and the flanks bright chestnut, brilliantly streaked with white. This quail, one of the most conspicuous and pleasing forms of desert life, is numerous wherever it can find sufficient food and water. For ages it has claimed many a remote watering place as its own, but it welcomes the settler and finds additional shelter and food in his irrigated fields. Under the new conditions its numbers increase and it repays the favors received by becoming semidomesticated. Its presence adds a touch of bright color and animation to the dreary surroundings of many a lonely desert ranch.

The California valley quail belongs entirely to the Pacific coast, and probably is the most beautiful of the smaller gallinaceous birds of the world. It resembles the Gambel quail in its recurving black crest and general appearance, but exceeds that bird in the richness of its colors and markings. It is abundant in most parts of California.

The California mountain quail, the largest and one of the handsomest of this group, inhabits the wooded mountains of the Pacific coast, and bears a superficial resemblance to the red-legged partridge of Europe. Like the Mearns quail, its haunts are usually more remote from cultivated lands than are those of the other species.

The services to agriculture of the western quails, while in most cases appreciable, are far less valuable than those of bobwhite, mainly because the birds are much less insectivorous. Moreover, the California valley quail sometimes damages the grape crop.

The value of a single game bird is of course small, and it is from this narrow point of view that its relation to the community is usually considered. When, however, the value of any important species is worked out the result is surprising. It has been conclusively demonstrated that in Virginia and North Carolina alone the common quail annually destroys many tons of noxious insects and weed seeds. The great value of this service must be apparent to all who appreciate the never-ending warfare between the farmer and his hydra-headed enemies, the insects and weeds. The food value also of the quail is great, and the health and pleasure derived from their pursuit has resulted in the investment of millions of dollars. When it is generally understood that by judicious effort the numbers of these useful birds may be greatly increased, with a proportionate benefit to all concerned, it is hoped that efforts to this end will not be long delayed.

THE BOBWHITE.

(*Colinus virginianus.*)[a]

The bobwhite is one of the most widely distributed and popular game birds of the United States, but in many places it is suffering ruthless extermination. Sportsmen, farmers, legislators, and ornithologists, as well as the friends of birds in general, should interest themselves in the problem of its preservation. In the Northern, Western, and Middle States it is commonly known as 'quail,' in the Southern States as 'partridge.' This tends to confusion, since in New England and northern New York the name 'partridge' is commonly applied to the ruffed grouse. Both names were brought to America by English colonists from their Old World homes, where they are applied to species not originally inhabiting this continent. The name 'bobwhite' is from the familiar call note of the bird.

In some of its characteristics bobwhite differs strikingly from other members of the family. For example, the crest—a well-developed adornment of several closely related American quails—in bobwhite is invisible except when the bird is excited.

The common bobwhite ranges more or less generally over the eastern half of the United States and southern Ontario, except in the colder, mountainous parts, from southern Maine to northern Florida, and west to South Dakota, Nebraska, Kansas, and Texas. In addition, colonies have been introduced and found to thrive in various localities in Colorado, New Mexico, Utah, Idaho, California, Oregon, Washington, and the island of Jamaica. South of the home of the typical bird, just outlined, bobwhites have a wide range, occupying Florida, western and southern Texas, Cuba, and a large part of Mexico, and extending even beyond the border of Guatemala. Owing chiefly to climatic influences the southern birds differ more or less from the northern ones. The masked bobwhite (*Colinus ridgwayi*), a closely related but separate species, once lived in extreme southern Arizona and the adjoining part of Sonora, but now it is probably extinct within our borders. With this exception all of the bobwhites from Canada to Guatemala and Cuba, according to E. W. Nelson, belong to a single species modified by environment into a considerable number of forms, some of which are strikingly different from the birds of the United States. The Florida bobwhite, which is peculiar to the peninsula of Florida, is smaller and darker than the northern bird. The Texas bobwhite of western Texas and northeastern Mexico is about the same size as the northern one, but is paler and has a light rufous collar below the black band and bordering the white throat patch. The Salvin bobwhite from the southern border of Mexico is very unlike the common bird of the United States, most of the head, neck, and breast being plain black and the rest of the underparts plain rufous.

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[a] The name is used here in its broad sense to cover the typical bird of the Eastern States, *Colinus virginianus*, and the two subspecies, the Florida bobwhite (*C. v. floridanus*) and the Texas bobwhite (*C. v. texanus*).

The present account is limited to the bobwhites of the United States, including the Texas and Florida forms. The writer's field work in this connection has been principally in New Jersey, Virginia, and Maryland—on a farm at Marshall Hall, Md., which is directly across the Potomac from Mount Vernon.

CALL NOTES.

In the field the nuptial call note of the cockbird is an infallible guide to its identity. This familiar challenge, sounding to the sportsman like '*bob white*,' '*bob-bob-white*,' and to the farmer like '*more wet*' or '*no more wet*,' is by no means the only note of the species during the breeding season. It was the good fortune of the writer during the last week of June, 1902, to hear the nesting note and other calls. Again and again the cock left his distant perch, where he had been whistling 'bob white,' and, still calling, approached the nest on the bank of a little sluggish briery run between open fields. When within 50 yards of his mate he uttered the rally note, so thrilling to the sportsman in the fall, '*ka-loi-kee*,' which the hen often answered with a single clear whistle. Then followed a series of queer responsive 'caterwaulings,' more unbirdlike than those of the yellow-breasted chat, suggesting now the call of a cat to its kittens, now the scolding of a caged gray squirrel, now the alarm notes of a mother grouse blended with the strident cry of the guinea hen. As a finale sometimes came a loud rasping noise, not unlike the effort of a broken-voiced whip-poor-will. The favorite calling stations were rail fences at a height from 5 to 10 feet, and the limbs of trees along fence rows. One bird whistled in a tulip tree at least 35 feet from the ground. H. H. Miller reports that April 25, 1903, was the earliest date of nuptial notes at Sandy Spring, Md. After the breeding season the bird discontinues this characteristic call. During August 19–21, 1902, it was heard only on one occasion at Marshall Hall, where the birds are numerous, and ceased after a dozen repetitions. Edward A. Preble, of the Biological Survey, has recorded the 'bob-white' call at Wilmington, Mass., as late as October 20.

The notes of the bobwhite in fall and winter have been described by many writers. The following quotation from Mr. Sandys gives an admirable description of the call notes of a covey that has been scattered by the sportsman and is trying to reassemble for the night, a notation so accurate as instantly to recall the notes to one who has heard them: "Over the brow of a hill comes the low, tender call of the hen to her youngsters, '*ka-loi-kee*, *ka-loi-kee;*' and, perhaps, from the broomsedge beside the observer comes the loud vibrant answer, '*whoil-kee*.'" This call is usually sounded in the late afternoon, but December 31, 1901, at Woodbridge, Va., a scattered flock was heard calling persistently in the morning.

On one occasion the writer watched a bobwhite whistling from a fence rail 10 feet away. At such close range the whistle lost all its melody and became a nasal shriek which was almost painful to the ear. It was repeated on an average five or six times a minute and consisted of either two or three notes, of which the first was so low as to be inaudible a hundred yards away, and the last was strikingly louder. The mode of delivery was peculiar; sitting in a normal, erect position the bird emitted the first note, then depressing the tip of the bill almost to touch its breast, with a motion as though hiccoughing, it gave the second, then throwing back its head and pointing its bill skyward it uttered the explosive, far-reaching third note.

BREEDING HABITS.

The nesting time of bobwhite in each section of the bird's range is usually limited to a fairly well-defined period, but varies considerably in the time of beginning, the difference being partly seasonal and partly regional. About Washington, D. C., the coveys usually break up the first part of May, one covey being seen in 1899 as late as May 9. In 1902 the first nest with eggs was found at Marshall Hall on May 29, and the first downy chicks on July 6. Between the end of June and last of August seven pairs of birds were found there which had recently mated or were incubating. This was shown by the fact that the cock birds were flushed thirty-six times and the hens only four times. During the same season five nests were found between July 15 and 19 at Sandy Spring, Md., less than 20 miles away. One of these nests contained 24 eggs. Even larger clutches are recorded, and one nest found at Woodstock, Ohio, is reported to have contained 42 eggs.[a] Such large clutches probably are the product of more than one bird. In 1903 nesting appeared to be later than in 1902, as the first eggs found were discovered July 10. The farmers at Marshall Hall say that they usually find the first downy chicks during wheat harvest, usually the last week of June. A number of broods of chicks were seen about Marshall Hall from July to September.

The newly hatched young have chocolate-streaked heads, and resemble small black and red bantam chicks. Whenever these newly hatched chicks remain motionless their protective coloration renders them invisible unless one makes a most careful search.

From information at hand it appears that the main breeding season for bobwhite in the Northern States, including the country about Washington, D. C., is during May, June, and the first half of July. Florida birds begin to breed regularly the first of April (though some are much earlier), and continue nesting till well into June. Texas birds nest mainly in April and May, but some nest as late as September. Throughout its range some of the birds breed earlier and others later than the main body of the species, and the occurrence of second or even third broods may lengthen the season. Robert Ridgway found a clutch of freshly deposited eggs in southern Illinois on October 16, and H. C. Munger found another set in Missouri in January, the parent being afterwards found frozen on the nest. Authentic records from various parts of its range show that bobwhite has been known to breed, at least occasionally, somewhere in its range every month of the year except December. This seems to prove that under certain circumstances bobwhite, like the domestic hen, will lay a clutch of eggs at any time of year.

The occasional presence with the female of young of two or three sizes appears to show that at least two broods are sometimes raised in a season, but we lack definite information on this subject. Major Bendire gives twenty-four days as the period of incubation. The male is reported as sometimes assisting in this duty.

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[a] Forest and Stream, X, p. 399, 1878.

GENERAL HABITS OF THE BOBWHITE.

The habits of bobwhite, like those of many other birds, vary considerably, and the following, observed by E. W. Nelson, is a case in point. In 1875 the Wabash bottoms near Mount Carmel, Ill., were covered with a magnificent forest, quite tropical in the size and luxuriant growth of trees and other vegetation. Scattered here and there through the forest were small clearings planted to corn. Bobwhites were found about all of these clearings, and the males were commonly heard calling from the tops of tall trees in the edge of the bordering forest, and on more than one occasion were stalked and shot in the midst of the woods from tree tops more than 100 feet from the ground. When flushed in the cornfields the coveys dashed away into the forest, where they took refuge in the tree tops, thence sending forth their rallying call notes.

There appears to be a tendency among bobwhites, at least in some regions, to a local migration. In certain sections, as in Virginia and Maryland, they commonly leave their summer homes on the approach of winter and congregate near the larger watercourses. In an old number of the American Sportsman Lewis refers to this fall movement, and says: "At this period the birds are said to be running or traveling, and will not lie to a dog; and to pursue is lost time, as it will be found utterly impossible to keep up with them, no matter with what speed you attempt it."

The habits of the bobwhite during the hunting season are well known. The birds move about most actively and feed in the early morning and late afternoon. The best shooting is to be had the hour before sunset, in the places where the birds have decided to spend the night. They roost on the ground, forming a solid ring with tails in and heads out. In Virginia and Maryland the roosting places are almost never in the woods, though in Mecklenburg County, Va., the writer has found them in grassy, briery little clearings among pine woods. At Marshall Hall the birds were found roosting in the edges of woodland, orchards, patches of ragweed in wheat stubble, cornfields, truck plats, broomsedge, dewberry and blackberry tangles, pastures, and fence corners. In Massachusetts Edward A. Preble found no roosts in the open fields, but found them among scrub oaks and in tall pine forests. Bobwhites habitually use a roosting ground again and again. A covey of a dozen, found the middle of November, 1899, at Marshall Hall, resorted to a corner of a peach orchard for eight consecutive nights, and during December, 1902, a covey of fifteen on the Roanoke River bottom used a narrow strip of cockleburr, ragweed, and smartweed for ten consecutive nights. It is interesting to note that, although quail seek the woods for shelter from enemies during the day, they generally regard the open as safer at night.

It is the general opinion that with the on-coming of winter the bobwhite is found less often in the open fields, where withered herbaceous plants afford but scant protection from enemies, than in dense bushy briery coverts and woods.

In Maryland and Virginia the scattered and depleted coveys after the shooting season evidently unite into large bevies. Their favorite resort in severe weather is a bank with southern exposure and suitable food supply. At Marshall Hall during one of the heaviest snowfalls of the season, when the Potomac was frozen over and the thermometer near zero, a covey was always to be found on the southeast side of a steep bank bordering a large swamp. Here the birds found food and warmth, for the rays of the sun fell on this slope so directly that even when the snow elsewhere lay from 3 to 6 inches deep it was here melted or remained only in patches. It was noticeable that when snow was on the ground the birds ventured only a few rods from cover, a fact that apparently indicated their appreciation of danger from the numerous hawks and foxes. At Kinsale, Va., the writer found bobwhites crossing open fields when there was an inch or two of snow, though for the most part they kept close to cover. In April and May the birds again venture out into the open, and they breed when vegetation is sufficiently grown to conceal the nests.

At Marshall Hall little oval pits in dry soil, in which quail had been dusting, were found in various situations, usually under cover of weeds and bushes about the fields. Dusting is a part of the toilet of all gallinaceous and many other birds, and may also be a protection against vermin.

BOBWHITE AS AN ALLY OF THE FARMER.

In summing up the relations of the bobwhite to agriculture it will be well to emphasize certain facts developed by our investigation of its food habits. In the first place, careful observations at Marshall Hall, where the acreage under cultivation is large and the bobwhite abundant, and less extended investigations elsewhere afford no evidence that the species does appreciable injury to crops of grain or fruit. Further, its habit of destroying weed seeds is of much economic importance. For instance, it is reasonable to assume that in the States of Virginia and North Carolina, from September 1 to April 30, the season when the largest proportion of weed seed is consumed by birds, there are four bobwhites to each square mile of land, or 354,820 in the two States. The crop of each bird holds half an ounce of seeds and is filled twice a day. Since at each of the two daily meals weed seeds constitute at least half the contents of the crop, or a quarter of an ounce, a half ounce daily is consumed by each bird. On this basis the total consumption of weed seeds by bobwhites from September 1 to April 30 in Virginia and North Carolina amounts to 1,341 tons. It is to be remembered also that if it were not for foxes, hawks, and trespassing pot hunters the birds would be more abundant and their services correspondingly greater. Insects form about one-third of the bobwhite's diet from June 1 to August 31; and a calculation similar to the one employed above shows that 340 tons of insects are destroyed during this period.

Among the insects consumed by the bird are such very harmful pests as the Rocky Mountain locust, the chinch bug, the Colorado potato beetle, the Mexican cotton boll weevil, cutworms, the two cotton worms, and the army worm. The highly insectivorous chicks cause a proportionally greater destruction of insects than the adult birds. Further, while many other useful birds confine themselves to the woodland or swamp, or merely scout along waterways, hedges, and fence rows, the bobwhite feeds directly among field crops. In the South it is found in cotton fields; in the North it delights in the ragweed-grown wheat stubble; in the West its favorite feeding ground is corn fields, and it often spends the night there instead of flying to cover as do most birds. The facility with which it passes from field to field, either on foot or on the wing, distributes its services to an unusual degree.

BOBWHITE AS AN ASSET OF THE FARM.

Every landowner should realize the value of the bobwhite, and should demand from sportsmen a fair price for the birds killed on his property. With proper management some farms of from 500 to 1,000 acres would probably yield a better revenue from bobwhites than from poultry. Many farms in North Carolina derive a regular income from this source. This is obtained by leasing the shooting right to wealthy sportsmen, who, in localities where birds are abundant, willingly pay considerable sums for the privilege. This is probably the most profitable use to which certain poor lands in the South can be put. In some places in Maryland, Virginia, and North Carolina the sportsman often pays the landowner from 5 to 25 cents for every bird shot. In other places the farmer or his boy is hired as guide to locate the quail. In addition the sportsman pays liberally for his board and otherwise adds to the farmer's income. Wide-awake farmers appreciate the fact that the genuine sportsman pays well for his sport and should discriminate between him and the market hunter. Millions of dollars can be realized by the proper management of the quail crop of the United States. The time is perhaps not far distant when landowners will protect their game birds from foxes, injurious hawks, and human poachers as diligently as they now do their poultry. The sooner the farmer realizes the value of the bobwhite and the fact that the market hunter is a bird exterminator, profiting at the landowner's expense, the better will be his chance of an income from his crop of quail.

BOBWHITE AS AN ARTICLE OF FOOD.

Perhaps no game is more generally known and liked than quail. The flesh of the bobwhite is juicy, tender, delicately flavored, easily digested, and nutritious. It is well adapted to the needs of invalids. To the farmer's table, where fresh meat is often not obtainable, this bird furnishes a welcome supply. No game is so much sought for in market, and countless numbers are sold every year. The writer knows of a single dealer in Washington who in 1902 sold 100,000 quail. Yet the supply is far short of the demand, and the price is constantly rising. In connection with the present price, which is $3 to $5 a dozen, it is interesting to recall Audubon's statement that in 1810 these birds could be bought for 12 cents a dozen and in 1831 for 50 cents.[a] Then they were on the tables of rich and poor alike.

BOBWHITE AS AN OBJECT OF SPORT.

Edwyn Sandys says of the bobwhite: "He truly is the king of his race; and not alone that, for, in the opinion of hosts of enthusiastic sportsmen, he is the best bird that flies." The well-known author T. S. Van Dyke says: " Dear little Bob White has brought more rest to the business-wearied soul, more new life to tired humanity than nearly all other American game combined." The pursuit of many kinds of game is possible only in the distant wilderness, where traveling is difficult and the exposure incident to the sport may be dangerous to health; but the pursuit of the bobwhite belongs to open, accessible country, and is not too severe for men accustomed to a sedentary life. To thousands of such men quail hunting is the yearly means of restoration, and results in a direct benefit to the community, though one not readily computed in money value. At a conservative estimate, between 300,000 and 400,000 sportsmen go out from cities every fall to hunt bobwhite, which means a large expenditure of money, much of which goes to farmers who hold shooting land. Such revenue is timely, for it comes when farm work yields small returns and employment is welcome. Where nonresident licenses are required, with fee of from $5 to $25, the State also derives a direct income from the sport.

The bobwhite deservedly stands at the head of American game birds, because it lies so well to the dog, and when flushed springs from the earth like an arrow, demanding a quick eye and a trained touch on the trigger to bring it to bag. When, at the advance of the hunter, the covey explodes like a bomb, his skill is sharply tested if he would bring one of the whirring, meteorlike projectiles to the ground. Birds of a scattered covey are hard to find. Good authorities say that when they alight they remain quiet and compress their feathers to the body, with the result of withholding the scent. Many sportsmen, therefore, before hunting a scattered covey, give them time to run about and leave scent.

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[a] Ornith. Biog., I, p. 392, 1831.

Paradoxical as it may seem, sportsmen exert a powerful influence for the protection of bobwhite. Many individuals and clubs own or lease large tracts, where they maintain the birds and shoot only the surplus. These enthusiasts assist in the enforcement of game laws, restock depleted covers, and provide food for the birds in times of scarcity. Certain clubs are organized for the purpose of holding field trials, the object of which is to test the ability of competing dogs to find and point birds. As retrieving is not required, the birds are not shot. One of the best-known patrons of field trials recently told the writer that he had not killed a bobwhite in ten years. A number of clubs control each a preserve of from 5,000 to 20,000 acres, on which no shooting is allowed—or, if permitted, is carefully regulated—and suitable measures are taken for protecting birds and facilitating their propagation. These trials are held in a score or more of States, and in some of the larger contests more than a hundred dogs are entered. Some owners of field-trial dogs have preserves of their own, stocked with hundreds of pairs of bobwhites. Thousands of live birds for the above purposes are in demand, at high prices. If the bobwhite could be domesticated and reared in captivity for sale, the enterprise would doubtless be very profitable. From these facts it is evident that the sport of hunting bobwhite contributes to the health and happiness of thousands of men, and that in various ways it can be made to add to the prosperity of farmers and others interested.

ESTHETIC VALUE OF BOBWHITE.

Much money has been spent, and well spent, merely for the enjoyment of the beauty and companionship of birds. For the protection of gulls and terns along the Atlantic coast thousands of dollars have been expended at the instance of bird lovers, in whose eyes these delicate and graceful creatures are the crowning attractions of marine landscape. In like manner the admirers of bobwhite derive esthetic pleasure from his presence. To pastoral inland scenes—woodlots in a green mist of young leaves, summer grass fields and bushy pastures, brown stubble, and skeleton cornfields—the bobwhite adds a distinctive charm—homely, but none the less attractive. As the bird calls from the fence post or runs fearlessly across the road, the stroller can but admire its trim, alert figure and tasteful color pattern of black, white, and brown, set off with delicate tintings of blue-gray. Its mellow whistle seems a proffer of good-fellowship, investing even a solitude with cheer, while the plaintive covey-call heard in the growing darkness to summon a scattered flock to the nightly resting place is one of the tenderest of evening sounds. Because of such traits the bird has made many friends, some of whom spend time and money to insure its undisturbed presence in their neighborhood.

DECREASE OF BOBWHITE.

Every few years, on the recurrence of unusually severe winters with heavy snows which cover the food supply, great numbers of bobwhites perish, and sometimes in the northern part of its range the bird becomes almost extinct. This unnecessary loss of life could be largely prevented if landowners and others interested would scatter a little grain in suitable places. This is done in some localities, as at Sandy Spring, Md., where H. H. Miller drives over the snow-covered country, scattering grain for the starving quail. The practice is worthy of general adoption. It is necessary only while the ground is snowbound, and especially after sleet storms.

The bobwhite has taken kindly to civilization and has followed the plow of the settler into new sections, so that with the advance of the farming area in the West, and especially in the Northwest, its range has been much extended.

There is little doubt, however, that, while the bobwhite is a fairly hardy and prolific species, its numbers are decreasing in much, if not all, of its range, where not specially protected. In the early fifties Lewis reported 61 birds killed in a day to a single muzzle loader, and mentions 900 birds trapped on one estate in a season. Within the last few years the scarcity of bobwhites has been so notable that several projected field trials have been abandoned for lack of birds on which to try the dogs.

Severe winters, as already noted, are an occasional cause for a great decrease in the number of the birds, though they increase rapidly with a few succeeding good seasons. In sections where the birds are still common unlimited slaughter is often indulged in by thoughtless hunters. Recent instances of such slaughter are on record, and the following may be cited: A bag of 175 birds to three guns in eight hours in the fall of 1902 at Tiffin, Ohio,[a] another of 300 birds to a single gun in a day and a half in the fall of 1902, in Marshall County, Ky.,[b] and still another of 292 birds to three guns in a day in South

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[a] Recreation, vol. 17, p. 120.

[b] Ibid., vol. 19, p. 41.

Carolina during the same season.[a] The value of this bird, both to the farmer and the sportsman, renders the question of its maintenance and increase one of much importance. So assiduously is the bobwhite sought by sportsmen and market hunters that intelligent and concerted efforts are needed even to maintain its present numbers.

LEGISLATION IN BEHALF OF BOBWHITE.

In addition to natural causes, reasons for the diminished numbers of bobwhites are diversity in the open season, shooting out of season, excessive shooting in season, and unrestricted shooting and trapping for market. Lack of uniformity in laws of adjoining States, and in some cases of adjoining counties, renders their observance difficult and their enforcement often impossible. No other game bird has been the subject of so much legislation, which, beginning in New York in 1791, now extends to every State and Territory where the bird is native or has been introduced. The length of season during which the bird should be protected by law is a matter of paramount importance. It goes without saying that no shooting should be permitted during the breeding season, which must be understood to last until the young of the year are strong of wing and fully developed for the struggle for existence. Besides this the close season ought to include months of rest, during which the birds can fortify themselves for the physiological strain of the next period of reproduction. As now established the open season varies from twenty-one days in Ohio to seven months in Mississippi. In North Carolina, however, where nearly every county has its own law, the bobwhite may be shot throughout the year in five counties. Virginia has recently abolished county laws and established uniformity, an example that other States, especially Southern States, would do well to follow. It is gratifying to note that in 1903 the open seasons were shortened by New York, Illinois, Texas, and Virginia. In eight States—Maine, Rhode Island, Wisconsin, North Dakota, Montana, Colorado, Wyoming, and Utah—the bobwhite is absolutely protected for a term of years, extending to 1920 in Colorado. Two conditions justify such prohibition of shooting. First, when excessive shooting or other causes have made recuperation necessary; second, when birds just introduced into a new locality need time to establish themselves. Wherever the bird can not hold its own with an open season of three weeks absolute protection for a period of years is demanded. The length of the open season must vary with varying conditions, but in view of the general decrease of the birds there would seem to be a growing need for shortening it. The sooner Northern States limit their shooting to one month the better. Even

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[a] Recreation, vol. 16, p. 372.

Southern birds can not stand the present continuous fusillade of from four to seven months, and the open season in the South should be limited to two or, at most, three months.

The slaughter of the bobwhite by sportsmen who hunt for pleasure is insignificant in comparison with that by professional market hunters. At the present time (1904), in about 25 States, the law takes cognizance of this fact by prohibiting the sale of birds killed within the State or imported from other States, and the general tendency altogether to prohibit the sale is growing each year. Every State except Mississippi forbids the sending of certain game outside the State—a restriction on the sportsman as well as the market hunter, although the privilege of carrying home a limited amount of game is often granted under a nonresident license. Fourteen States have laws, also affecting both classes, limiting a day's bag to from 5 to 50 birds. Many sportsmen and farmers would be glad if the limit were set at 12. Laws discriminating against nonresidents protect the game and benefit the landowner, provided visiting sportsmen are not barred altogether by unreasonable fees. Thirty-one States and Territories require nonresident licenses. In addition to State game laws there are certain Federal laws, the most important of which is the Lacey Act, which provides, among other things, through the Department of Agriculture, for the preservation, distribution, introduction, and restoration of game birds, and also undertakes to bring to justice persons who transport from one State to another game killed in violation of local laws. The latter clause proves effective in restricting such illegal shipments and in suppressing professional dealers that kill out of season in one State and attempt to sell in another where the season is still open. A law to prevent keeping birds in cold storage from one season to another would stop certain loopholes in the present laws and greatly aid in preserving game. An effective system of State game officials where it is lacking would aid in enforcing game laws. A number of States depend solely on county officers; but experience has shown that without a central State organization and special game wardens the law to a great extent becomes a dead letter.

MEASURES FOR PRESERVATION AND PROPAGATION.

Stringent laws against trapping the bobwhite have been enacted, but such legislation should permit legitimate trapping for purposes of propagation. One of the most important problems before game commissioners is the restocking of depleted covers. If, however, the bobwhite can be reared successfully in captivity, all trapping may be prohibited. The sporting magazines ('Forest and Stream' and 'American Field') mention cases of the bird's laying in captivity and raising its young; and in a letter to the writer, dated September 2, 1904, G. W. Jack, of Shreveport, La., says:

> I now have a pair of quails (bobwhites) which were trapped last winter and which I keep in a large wire coop. They have made a nest in some grass and have laid about 12 or 15 eggs.
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> The eggs were laid very irregularly, not more than two or three a week, so that by the time the nest was full the season was far advanced, which perhaps accounts for the female not sitting. The eggs were set under a hen and proved fertile, but the young were eaten by the chicken as fast as they hatched. I concluded that this irregularity or slowness in laying was the result of the lack of insect and other egg-producing food, as the birds subsist almost wholly on grain. Of late, however, they have learned to eat with much relish the yolk of an egg hard boiled.

The failure of the female to sit was probably due to the unnatural confinement in so small a space, a difficulty which could readily be remedied if attempts to raise quail were made on a large scale. Unquestionably, too, it would be necessary to feed the quail, at least during the nesting period, to a considerable extent upon animal food.

An instructive account of quail breeding in confinement appears in Forest and Stream for September 28, 1882 (p. 164). The female had been hatched and reared by a bantam hen, and this circumstance has an important bearing on experiments of this kind. It is altogether probable that bobwhites hatched and reared in this way would lend themselves to experiments in propagation far more readily than wild birds trapped for the purpose.

The Department of Agriculture obtained three pairs of bobwhites from Kansas, which after five months' captivity are almost as wild as when first caged and show no signs of mating. Experiments in the domestication of bobwhite are well worth trying, however, because of the demand from clubs and individuals for live birds to restock their grounds. So great has become the demand in recent years that it is estimated that 200,000 birds would be required annually to fill it. During the spring of 1903 the demand far exceeded the supply, even at $5 a dozen, and sometimes at twice that figure.

Success in increasing the numbers of bobwhite depends largely on controlling its natural enemies, which include snakes, foxes, weasels, minks, skunks, domestic cats, and certain hawks and owls. Several species of snakes eat its eggs and young. Writing from Texas, Major Bendire says: "The many large rattlesnakes found here are their worst enemies. One killed in May had swallowed five of these birds at one meal; another had eaten a female, evidently caught on her nest, and half a dozen of her eggs; a third had taken four bobwhites and a scaled partridge."[a] In Mecklenburg County, Va., the king snake (*Lampropeltis getula*) has been known to eat a clutch of eggs. At Falls Church, Va., Harvey Riley captured a black snake (*Bascanion constrictor*) which disgorged a newly hatched bobwhite. Reference has been made already to the marked decrease in the number of bobwhites on the 230-acre farm at Marshall Hall, from fifty-odd birds in July to less than a dozen in December, though not more than a dozen had been shot. This decrease was probably due, at least in part, to gray foxes; for in August and September these animals were numerous, and often came after the chickens within a stone's throw of the farmhouse. Other predaceous mammals and birds of prey were not numerous, but foxes frequently were seen at midday searching through pastures where there were broods of bobwhites. It must be easy for a fox to exterminate a whole brood of newly hatched bobwhites, and no difficult task to catch them even when three-fourths grown. Minks and weasels, when numerous, are probably even more destructive to young bobwhites than to domestic poultry. The domestic cat that takes to foraging in woods and fields is also a menace and should be shot on suspicion, for it undoubtedly preys on game birds, as it is known to do on song birds and young rabbits.

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[a] Life Hist. N. Am. Birds [I], p. 8, 1892.

In Maryland and Virginia the writer has found the crow plundering nests of the bobwhite, and in these States the crow is an enemy also of poultry. Doctor Fisher states in his Hawks and Owls of the United States that of the forty-odd species which he studied he found only nine that killed the bobwhite. Four of these—the goshawk, Cooper hawk, sharp-shinned hawk, and great-horned owl—are very destructive to poultry as well as game. Dr. W. C. Strode, of Bernadotte, Ill., writes that bobwhite's worst enemy is the Cooper hawk. "A few days ago one flew up from the roadside when I was passing, and a bobwhite was dangling from one foot." During November, 1900, this species so persecuted the birds at Marshall Hall that they were seldom found far from cover. In one instance a hawk was seen to swoop to the ground and rise with a cock bobwhite. The other species of hawks and owls rarely molest quail.

If bobwhites more frequently nested along fence rows instead of in open mowing land, they would abound in many places where they are rare. The mowing machine lays many nests bare, and they are either despoiled by enemies or deserted by the old birds. At Sandy Spring, Md., early in July, 1903, four nests with their eggs were cut over in a 50-acre grass lot. In other hay fields several nests were discovered in time to leave grass uncut about them, but boys robbed them all. Between such lads and the crows and other enemies bobwhites have a hard time in certain sections.

To enable them to withstand the winter, bobwhites need suitable food and cover. In severe winters coveys are sometimes saved by being trapped and fed in confinement until spring. Naturally the birds suffer most in the northern part of their range, but there are reports of their death from severe and protracted cold in Maryland and Virginia. Sandys says: "The birds know when the snow is coming, and they creep under the brush, intending to remain there until the weather has cleared. * * * Then the rain comes and wets the surface all about, then the sleet stiffens it, * * * the cold becomes intense, and every foot of damp snow promptly hardens into solid ice. * * * The quail are now imprisoned beneath a dome of crystal, which may endure for days."[a] H. C. Oberholser says that in severe winters in Wayne County, Ohio, whole coveys are found dead from this cause. Dr. P. L. Hatch reports that in Minnesota the birds increase in numbers during years with mild winters and decrease when the winter is exceptionally severe.[b] Wilson Flagg states in Birds and Seasons of New England that thousands of bobwhites were destroyed by the deep snows of 1856–57. During the very severe winter of 1903–4 bobwhites were nearly exterminated in portions of Massachusetts. That quail do not always succumb to exceptional cold appears from the fact that in Susquehanna County, Pa., at an altitude of 2,000 feet, W. W. Cooke found a covey of a dozen bobwhites apparently in the best of condition on December 9, 1902, though a foot of snow covered the ground and the thermometer stood at 20° below zero.

A study of the winter habits of the bobwhite by the writer in the vicinity of Washington, D. C., so far has yielded only fragmentary results. In February, 1900, after a foot of snow had fallen, in a careful two days' search he failed to discover even a track of a large covey that usually frequented river flats along the Potomac at Marshall Hall. The birds must have been under the snow or back in the timber. At Falls Church, Va., after a lighter fall of snow he saw a covey of five moving among briers on the edge of a wood, and their fresh tracks showed that they had been feeding systematically on rose hips, but had not ventured from cover. At Cabin John Bridge, Md., after a snowfall of several inches his dog pointed six birds on the south side of a river bluff, where the sun had melted holes in the snow. On one of these bare spots he saw two birds, which rose and were joined by four others. The covey had made wallows 2 inches deep in the leaf mold on the bare spots. All the birds had avoided stepping on the snow. At hand was such food as the berries of sumac and the seeds of *Galactia volubilis* and *Chamæchrista fascicularis*. Examination of the droppings indicated that less than one-tenth of the food had been animal matter, the remains of which consisted of ants, the tibiæ of grasshoppers, the spotted cuticle of soldier bugs, and the cow-horn-like mandibles of spiders. So far as could be made out, the remains of vegetable food consisted of the skin of kernels of corn, fragments of the akenes of ragweed, and pulverized bits of sumac seeds (*Rhus copallina*), partridge pea (*Chamæchrista fascicularis*), milk pea (*Galactia volubilis*), and crownbeard (*Verbesina*), besides unidentified leaf material. The weather had been severe for more than a week, but the birds were in good condition.

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[a] Upland Game Birds, p. 70, 1902.

[b] Notes on the Birds of Minnesota, p. 155, 1892.

On the Marshall Hall farm, a short distance back from the banks of the Potomac, is a swamp that has a steep bank with a southern exposure where there is usually more or less bare ground in patches. For several years bobwhites have made a winter haunt of this warm, sunny bank, and here some interesting observations were made February 18 and 19, 1902, when the snow was from 2 to 4 inches deep and the minimum temperature was 4° F. above zero. A covey had spent the night of February 17 not on the warm bank, comparatively bare of snow, but on the level above the bank, where they had squatted on the snow under a dewberry bush among broomsedge. Their feet and droppings had melted the snow, and subsequent freezing had formed an icy ring. The birds had not flown thither, but had walked from the swamp up the steep bank and through the broomsedge level. The next morning they had flown from the roost to the steep slope, had run along the edge of the swamp to a bushy, tree-bordered stream, then up its north bank for 300 yards and back on the south bank, and thence to the steep, sunny slope again. On their journey they had gone under every matted tangle of cat-brier vines—possibly for berries, but more probably for protection. At one point they had fed freely on sumac berries. The tracks of a fox were found with those of the birds for about 100 yards. On the morning of the 19th they traveled not more than 200 yards, this chiefly among outstanding willows and alders of the swamp and along the belt of land 5 to 20 yards wide between the boundary fence and the reeds of the swamp. In one place two pairs of birds had walked so near together as to cross one another's tracks; two single birds had made clear lines of tracks on one side of them, and a single bird had walked alone on the other side from 1 to 4 feet from his nearest companion. All had evidently eaten rose hips, mutilated remains of which still clung to the bushes. The covey might have been expected to range far and wide in the open fields for seeds and even to straw ricks for grain, but except when traveling to their roost they had never gone more than a rod from cover. Apparently fear of enemies restrained them.

An article in the American Field, February 25, 1899, by the well-known sportsman John Bolus, of Wooster, Ohio, illustrates the hardiness of the bobwhite. When several inches of snow were on the ground and the thermometer registered from 15 to 27 degrees below zero every night for a week, Mr. Bolus took a tramp to see how the birds had fared. He found no dead birds, but saw six thrifty coveys—81 birds in all. They were feeding on ragweed projecting from the snow, and were jumping up to reach seeds on sprays above their heads. Some coveys remained under shelter of little weed patches, but others ranged over the more open fields.

In Maryland and Virginia large landowners often feed their birds in severe weather. Wheat and corn are the best food, and should be scattered, if possible, among the briers where the birds are safe from hawks. Bobwhites have been known to feed with chickens in barnyards. By a little forethought landowners and sportsmen can easily make winter provision for their birds. Sumac bushes should be left along hedgerows and the edge of woodland to furnish food that is always above the snow and lasts well into spring. Twelve bobwhites collected in December in North Dakota had made nine-tenths of their food of sumac, having eaten from 50 to 300 berries each. A similar use, in coast regions, of the bayberry and wax myrtle has been noted. Their berries, as well as those of sumac, last till May, and the plants should always be spared by everyone who is interested in the welfare of the bobwhite. Smilax, affording little food but fine cover, and wild roses, giving both food and cover, are also valuable. Blackberry thickets, young pine woods, laurel, and holly furnish safe retreats from enemies.

The farmer can well afford to feed the bobwhite in winter, but he can not afford to spend as much time and money as the owner of game preserves, and for the latter class further suggestions may be helpful. In the Eastern and Southern States land that will not grow profitable crops may be used for the game preserve, provided it has water and bushy coverts. The use of the mowing machine, so destructive to eggs and young birds, should be avoided when possible during the breeding season. Wheat for the birds should be sown in long strips not over 50 yards wide. The best of the grain may be harvested and the rest left standing. On the stubble a luxuriant growth of ragweed will generally spring up—a perfect food supply, except that it does not last till spring; hence the need of sumac or bayberry. In regions too dry for ragweed to grow in the stubble, sunflowers are an excellent substitute. Sorghum, millet (*Chætochloa*), and possibly panicum may be planted and left standing. Pop corn will be found particularly valuable, as large corn can not easily be swallowed by the younger birds. Buckwheat, and in the South the nutritious cowpea, and the climbing false buckwheat, the thick tangles of which also afford good cover, bear excellent food. Other plants of the genus

Polygonum are fond of moist land, and furnish palatable seeds for the bobwhite; for instance, black bindweed (*Polygonum convolvulus*), *Pennsylvania persicaria* (*Persicaria pennsylvanicum*), and black heart (*Persicaria lapathifolia*). All wild leguminous plants should be left undisturbed, for the birds feed on seeds of most of our legumes. Small clumps of locusts may well be left in open fields to give both food and cover. Tick trefoil, bush clover, Japan clover, the milkpea, and the wild bean—all wild plants—are suitable for food. Of the summer fruits the dewberry is the most important, and in the absence of water furnishes a substitute; therefore these vines, nearly everywhere plentiful, should be left in places remote from water. A water supply is of course important. Streams with bush-grown banks through open fields are most valuable. Beside them will be found spreading panicum (*Panicum proliferum*), which shells out its grain a kernel or two at a time until well into spring. Birds find food, shade, water, and shelter in the vegetation along small streams. Marshes also afford cover and food. If connected with estuaries they often support a rank growth of wild rice, an ideal provision for birds. Sufficient shelter to protect the birds from hawks is almost indispensable. Oak and beech woods supply mast as well as shelter, but pines afford the best cover, and some of them, notably the longleaf pine, furnish food. A comfortable retreat for the coldest weather is invaluable. In Maryland and Virginia fields of heavy broomsedge answer this purpose well, but best of all is a steep bank with southern exposure, where the sun quickly melts the snow, and gives the birds a chance to forage on bare spots for food and gravel. If such a bank is not far from cover, and has a growth of briers on it to give the birds a feeling of security, it will become a favorite winter haunt and during severe weather is the best place to scatter grain. With a little help from man the bobwhite will be found to winter well even in the northern part of its range.

Bobwhite is prolific. A pair of birds under favorable conditions will raise a dozen young in a season. Then, too, it is long lived, for a bird kept in captivity is known to have reached the age of 9 years.[a] The outlook for the future of the species is most satisfactory, provided it is given even a small amount of care, with proper legal protection. The Audubon societies, with a membership of 65,000 to 70,000, which cherish the bobwhite for esthetic and humanitarian reasons, the sportsman who loves the whirr of its brown wings, and the farmer, whose enemies it destroys and whose resources it increases, can do much to favor the bird in its natural environment and to protect it by adequate and effectively enforced laws.

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[a] Forest and Stream, VII, p. 407, 1876.

FOOD HABITS OF BOBWHITE.

Both field and laboratory investigations of the food habits of the bobwhite have been conducted by the Biological Survey. The field work was confined chiefly to Maryland and Virginia, and, although it represents in some degree every month in the year, has been limited mainly to the breeding and the hunting seasons. The laboratory work to determine the different kinds of food and their proportions has included examination of the contents of crops and gizzards from 918 birds. This material was collected from 21 States, Canada, the District of Columbia, and Mexico, but chiefly from New York, Maryland, Virginia, Florida, Illinois, South Dakota, Nebraska, Kansas, and Texas. Stomachs were obtained each month of the year, but unfortunately few were collected in the breeding season. Laboratory work included also feeding experiments with three pairs of captive bobwhites obtained from Kansas.

The bird's digestive organs are well adapted to the character of its diet. The stomach, or gizzard, as it is commonly called, is provided with powerful muscles for grinding the hard seeds on which the bird largely subsists. The crop, a sac like enlargement of the œsophagus, is a mere membranous receptacle for first receiving the food, and is without muscles. Its capacity is usually from four to six times that of the stomach.

The bobwhite is insectivorous as well as graminivorous. It is, in fact, one of our most nearly omnivorous species. In addition to seeds, fruit, leaves, buds, tubers, and insects, it has been known to eat spiders, myriapods, crustaceans, mollusks, and even batrachians. The food for the year as a whole, calculated by volume and determined by analysis of the contents of 918 stomachs, consisted of vegetable matter, 83.59 per cent, and animal matter, 16.41 per cent. In addition, there was mineral matter varying in amount from 1 to 5 per cent of the gross contents of the stomachs, and in exceptional cases rising to 30 per cent. This usually consisted of sand, with coarser bits of quartz 2 to 7 mm. in diameter, which were taken to pulverize the food and thus render it easier of assimilation.

The vegetable part of the food consisted of grain, 17.38 per cent; various seeds, chiefly weeds, 52.83 per cent; fruit, 9.57 per cent, and miscellaneous vegetable matter, 3.81 per cent. The animal matter in the food was distributed as follows: Beetles, 6.92 per cent; grasshoppers, 3.71 per cent; bugs, 2.77 per cent; caterpillars, 0.95 per cent; miscellaneous insects, 0.70 per cent; and other invertebrates, largely spiders, 1.36 per cent.

The insect food of bobwhite, in comparison with that of other birds, is interesting. It includes fewer caterpillars, ants, and other Hymenoptera, but more bugs; and, singularly enough in a terrestrial feeder, nearly twice as large a proportion of beetles as of grasshoppers. The meadow lark, per contra, another terrestrial feeder, takes 29 per cent of grasshoppers and only 18 per cent of beetles.

The food of the bobwhite for the year is noteworthy in several respects. Its character varies with the season. From October to March it consists almost exclusively of vegetable matter—for February and March 99.8 per cent of vegetable food appearing in analysis—while in late spring and in summer it is made up largely of insects, August showing 44.1 per cent of insect food. The grain taken, as a rule, is derived neither from newly sown fields nor from standing crops, but is gleaned from stubble fields after harvest. Grain forms a less prominent part of the food than the seeds of weeds, which are the most important element of all and make up one-half of the food for the year. The most distinctive feature of this, as a whole, is the large proportion—15.52 per cent—of leguminous seeds, a food seldom eaten by the various species of sparrows or other terrestrial feeders. A small fraction of this seed comes from cultivated plants, especially the cowpea; the rest is derived from wild plants, most of them classed as weeds. Leguminous seeds appear to be most largely consumed during December, when they form 25 per cent of the food. The 15.05 per cent of insect food, although a comparatively small part of the total, is of extreme importance, since it contains many pests that are generally avoided by nongallinaceous birds. Noteworthy among these are the potato beetle, twelve-spotted cucumber beetle, striped cucumber beetle, squash ladybird beetle, various cutworms, the tobacco worm, army worm, cotton worm, cotton bollworm, the clover weevil, cotton boll weevil, imbricated snout beetle, May beetle, click beetle, the red-legged grasshopper, Rocky Mountain locust, and chinch bug.

It should be observed that in the search for these pests and for weed seeds the bobwhite, unlike many birds of the woodland, hedgerow, and orchard, extends its foraging to the center of the largest fields, thus protecting the growing crops.

Grain as Food.

Vegetable matter has long been known to be an important element of the food of the bobwhite; indeed, many people suppose that it constitutes the entire food of the bird. The impression that the bobwhite eats little else than grain has prevailed even among many sportsmen who have bagged most of their game in the stubble field. The present analysis, however, discloses that grain forms scarcely more than one-sixth of the food. Laboratory study shows that it is eaten in every month of the year, the maximum amount, 46 per cent of the food for the month, having been taken in March. In the specimens examined corn amounts to 11.96 per cent of the total food for the year, while all other kinds of grain collectively amount to only 5.42 per cent. Wheat (4.17 per cent) is next to corn in importance. As experiments with captive birds failed to show marked preference for either corn or wheat, the disproportion between the two above noted is probably due to the fact that more corn than wheat is grown in the country where our birds were obtained. The remaining cereal food (1.25 per cent of the total) is miscellaneous grain, including Kafir corn, sorghum, millet, buckwheat, barley, oats, and rye.

Grain-eating birds are likely to do much harm to crops. They may pull up sprouting grain, plunder the standing crop when it is in the milk, or forage among the sheaves at harvest time. The bobwhite, however, is a notable exception. The period of germination is the time when grain is liable to serious injury by birds. But not a single sprouting kernel was found in the crops and stomachs of quails examined. Field observations, during the years 1899 and 1900, at Marshall Hall gave similar evidence. While crows injured sprouting corn so seriously during May that several extensive replantings were necessary, bobwhites, unusually abundant in the vicinity at the same time, were never seen to disturb the germinating grain. During November, 1899, sprouting wheat was saved from crow blackbirds only by diligent use of the shotgun; but both then and in other seasons the bobwhite was rarely observed in winter-wheat fields and never was seen to molest the crop. Sprouting oats apparently were not molested, though extended observations were not made. No data are available for rye and millet, but in newly sown buckwheat fields in Essex County, N. J., which the writer saw ravaged by doves, there was no sign of injury by the bobwhites. Publications on economic ornithology and reports received by the Biological Survey add testimony of like character. It may safely be stated, therefore, that so far as at present known the bobwhite does no appreciable harm to sprouting grain.

In order to learn to what extent the species injures ripening grain, observations were made for several years at Marshall Hall. Unlike the crow and several kinds of blackbirds, the bobwhite did no damage there to corn in the milk, nor did it injure ripening wheat and oats. Flocks of English sparrows, however, might be seen feeding on wheat in the milk, and not uncommonly a score of goldfinches swayed on the panicles of ripening oats. A hen bobwhite shot in a field of ripe wheat, June 18, 1903, had much of the grain in its crop, though whether obtained from standing heads or from fallen kernels did not appear. As the bobwhite usually feeds on the ground, and as it was never seen feeding from the stalk at Marshall Hall, it appears probable that it seeks only the fallen grain. At wheat harvest it follows the binder, and at Marshall Hall was often seen in the harvest field picking up scattered wheat. It was not observed there on the shocks, appearing to find an abundance of waste kernels. At corn harvest also bobwhite takes its share from exposed ears; but the bird is not able to shuck corn, as do the crow and the wild goose. Several crops of ripe oats at Marshall Hall were watched during harvest time and furnished no evidence against the bobwhite. No report of injury by it elsewhere at harvest time has come to the Biological Survey, though damage may be done where peculiar local conditions conjoin with an overabundance of birds.

The bobwhite, however, is a persistent stubble feeder. As Mr. Sandys puts it, "He is the gleaner who never reaps, who guards the growing crops, who glories over a bounteous yield, yet is content to watch and wait for those lost grains which fall to him by right." Where fields of wheat stubble support a rank growth of ragweed the sportsman is most likely to find a feeding covey. At Marshall Hall, during September, October, and November, such fields are the favorite haunts of the birds. On this farm corn has a greater acreage than wheat, but the birds are much less often found in corn stubble; and, as stomach examinations show, they eat much less corn than wheat. Since experiments with captive birds showed no preference for wheat, food other than grain may have kept them on the wheat stubble. Along the Roanoke in Virginia, where wheat is not grown, bobwhites feed in corn fields.

On the Western prairies, where cornstalks left standing in the fields afford good cover, the birds are more often found in cornfields. Six birds collected from such fields in November, 1891, at Badger, Nebr., contained 181 whole kernels of corn; the smallest number in a crop was 20 and the largest 48.

It is not unusual to find from 100 to 200 grains of wheat in a crop. A bobwhite shot at West Appomattox, Va., in December, 1902, had its crop distended almost to bursting with 508 grains of wheat. This habit of gleaning waste grain after harvest is beneficial to the farm, for volunteer grain is not desirable, especially where certain insect pests or parasitic fungi are to be combated. As the scattered kernels are often too far afield to be gathered by domestic poultry, the services of the bobwhite in this respect are especially useful.

The bobwhite sometimes eats the seeds of certain cultivated leguminous plants. Both the black-eye and the clay cowpeas (*Vigna sinensis*) have been found in stomachs, and one contained 35 peas of the latter variety. In Westmoreland and Mecklenburg counties, Va., cowpea patches are favorite resorts for the birds in November and December. Garden peas were found in crops collected by Mr. Walter Hoxie at Frogmore, S. C. In rare instances the bobwhite picks up clover seeds, and it has been known to eat a lima bean. It may take also Kafir corn and sorghum, and it has a decided liking for millet (*Chætochloa italica*), a taste particularly noticeable in birds of Kansas, Nebraska, and South Dakota. A crop from Onaga, Kans., contained 1,000 millet seeds. No significant damage to millet has been reported and the birds may secure most of this food from stubble fields.

WEED SEEDS AS FOOD.

Weeds appropriate the space, light, water, and food of the plants that directly or indirectly support man. A million weeds may spring up on a single acre, and a single plant of one of these species may mature 100,000 seeds in a season. This process, if unchecked, may produce in the spring of the third year 10,000,000,000 weeds. The problem of weed destruction is perennial in every land; indeed, soil culture may be called a never ceasing war against weeds. Of the birds that aid the farmer in this struggle the bobwhite, the native sparrows, and the mourning dove are the most efficient. They attack weeds at that vital stage—the seed period—hence their work, especially against the annuals which depend on seeds for perpetuation, is of enormous practical value.

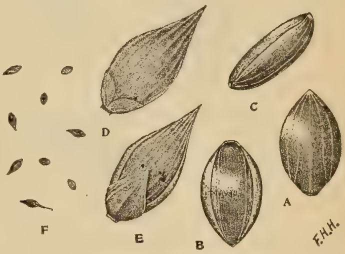

FIG. 1.—Seed of witch grass (*Panicum capillare*). (From Bull. 38, Nevada Agricultural Experiment Station.)

The bobwhite is preeminently a seed eater, 52.83 per cent of its food for the year consisting of seeds. The bulk of these are the seeds of plants belonging to the general category of weeds. Many of them are injurious plants with which the farmer is constantly at strife; others are less noxious and some are seldom, if ever, troublesome. Sixty-odd species are known to be eaten, and thorough observations would probably raise the number to a hundred or more. The food of no other bird with which the writer is acquainted is so varied. At Marshall Hall and in Mecklenburg and Westmoreland counties, Va., a somewhat detailed study was made of the weed seed eaten by the bird. At Marshall Hall fields of wheat stubble grown up to ragweed were favorite feeding grounds. Among others found there were buttonweed seeds, each like a miniature horsehoof, complete even to the frog; 20 or 30 of these were sometimes contained in a single stomach. A number of birds shot on wheat stubble had eaten largely of bastard pennyroyal seeds, which are rough and resemble blackberry seeds. Goldfinches and other seed eaters also find these palatable. Along ditches the abundant grasses—witch grass (fig. 1) and spreading panicum—provide the birds with shade in summer and a continuous harvest through the winter. The grain, inclosed in a cylindrical sheath which opens at the top, is rattled out, a few kernels at a time, by the strong fall and winter winds. Along the same ditches, especially in damper places among trees and bushes, another plant, the jewel weed, flourishes. Its ripened seeds, hurled from the opening pods by elastic coiled springlike valves, are eaten in large numbers by the bobwhite. The jewel-weed cotyledons are inclosed in a plain seed coat; but the cotyledons themselves are of a delicate robin's-egg blue, rounded and colored like tiny turquoises.

Several weeds injurious to truck crops are useful to the bobwhite. In a field where crab grass as a thick mat had overrun a patch of yams a covey spent much time gathering the seeds (fig. 2). In another place where lamb's-quarters was 6 feet high and pigweed still higher, a flock of busy weeders could almost always be flushed at certain hours. Patches of green foxtail grass often attracted a covey for an evening feed. In the northern part of the United States this plant grows rank, and in many sections furnishes the bird its main food for September and October. Near a stream in a truck flat was a forest of giant ragweed from 8 to 10 feet high, and here bobwhites were frequently seen picking up scattered seeds. Their favorite weed seed, however, is the common, or smaller, ragweed. At Marshall Hall this weed springs up, not only on truck land, but most luxuriantly in wheat stubble after harvest, covering the field with a rank growth 3 feet high. When abundant, its seeds are eaten in the fall more than those of any other plant, supplying a little over 16 per cent of the total food during October, November, and January. The fruits beset with a crowning circlet of spines are taken into the crop whole. In the stomach the brown oval seeds are freed from the spiny outer coat, crushed by the powerful muscular action, and made to yield their rich oily meat to the digestive juices.

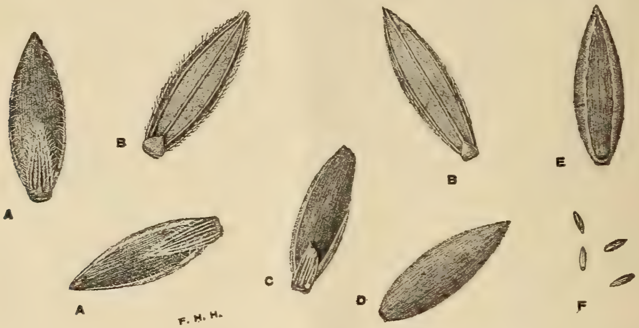

FIG. 2.—Seed of crab grass (*Syntherisma sanguinalis*). (From Bull. 47, Nevada Agricultural Experiment Station.)

In Mecklenburg County, Va., during the last week of December, 1902, a covey of a dozen bobwhites resorted to a cornfield to feed on the shining black seeds of smartweed, often a troublesome plant on low ground. In Westmoreland County, November, 1901, bobwhites fed freely on seeds of climbing false buckwheat, which festooned all the shrubbery along streams and afforded the birds admirable cover as well as food. The seeds of knot grass (fig. 3), a species related to the smartweeds and false buckwheat, also contribute to the food of the bobwhite.

The fondness of bobwhites for leguminous seeds has already been mentioned. On the edge of woodlands, along hedgerows, and to some extent in open ground, they consume large quantities of seeds of tick-trefoil, Japan clover, and bush clover, and their crops have been found distended with these seeds. They also find the partridge pea massed in great patches at Marshall Hall and in some places in Virginia, but it appears to be of less importance to them. A few stomachs contained as many as 100 of these seeds. In several sections the butterfly pea was eaten in about the same proportion as the partridge pea. The hog peanut, like the butterfly pea, a trailing plant bearing a small grayish-brown bean, furnished several times as much food as the partridge pea and butterfly pea combined. Of these seeds 600 are sometimes eaten at a meal. Southern birds relish the Florida coffee seeds and lupine seeds. Seeds from locust pods also are frequently eaten by the bobwhite.

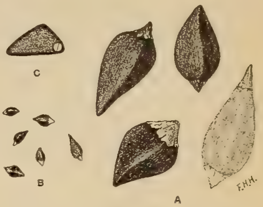

FIG. 3.—Seed of knot grass (*Polygonum aviculare*). (From Bull. 38, Nevada Agricultural Experiment Station.)

In the northeastern part of its range the bobwhite has been reported as feeding on seeds of the ill-scented skunk cabbage. Four of eight birds shot in October, 1902, at Wilmington, Mass., by Edward A. Preble, of the Biological Survey, had eaten them. These seeds are somewhat flattened and subspherical, and average about three-eighths of an inch in diameter. Two crops were filled with them, one containing 10 of these great seeds. This plant, abundant in northern swamps, may furnish food for birds in game preserves.

Seeds of different species of violets are often eaten. In some cases the three-valved seed pods, each valve containing a dozen or more seeds, had been swallowed entire. Seeds make up 50.36 per cent of the bobwhite's food, and a quantitative study of it shows that the grass family contributes 9.46 per cent; leguminous plants, 15.52 per cent; smartweed and other polygonums, 4.41 per cent; ragweed, 7.28 per cent; and miscellaneous weeds, 13.69 per cent. The number of seeds eaten at a meal may suggest the value of the bird as a weed destroyer. As many as 200 to 300 smartweed seeds, 500 seeds of red sorrel, and 700 seeds of three-seeded mercury have been taken at a meal. Crops and stomachs crammed with nothing but ragweed seeds are often found. A bird shot November 6, 1902, at Marshall Hall, had eaten 1,000 ragweed akenes; another killed there the previous November had eaten as many seeds of crab grass. Birds shot in Mecklenburg County, Va., contained about 2,000 leguminous seeds, mainly tick-trefoil, and various kinds of bush clover. A bird shot in October, 1902, at Pine Brook, N. J., had eaten 5,000 seeds of green foxtail grass, and one killed on Christmas day, 1901, at Kinsale, Va., had taken about 10,000 pigweed seeds.

LIST OF WEED SEEDS EATEN.

The list of seeds eaten, excluding mast and pine seeds, is as follows:

Slender paspalum (*Paspalum setaceum*).
Slender finger grass (*Syntherisma filiformis*).
Crab grass (*Syntherisma sanguinalis*).
Barnyard grass (*Echinochloa crus-galli*).
Barbed panicum (*Panicum barbulatum*).
Switch grass, tall smooth panicum (*Panicum virgatum*).
Spreading panicum (*Panicum proliferum*).
Witch grass (*Panicum capillare*).
Yellow foxtail (*Chætochloa glauca*).
Green foxtail (*Chætochloa viridis*).
Timothy (*Phleum pratense*).
Sheathed rush grass (*Sporobolus vaginæflorus*).
Slender spike grass (*Uniola laxa*).
Wild rice (*Zizania aquatica*).
Nut grass (*Cyperus rotundus*).
Rush (*Scirpus?*).
Sedge (*Carex* sp.).
Tussock sedge (*Carex stricta*).
Skunk cabbage (*Spathyema fœtida*).
Red sorrel (*Rumex acetosella*).
Curled dock (*Rumex crispus*).
Pale persicaria (*Persicaria lopathifolia*).
Pennsylvania persicaria (*Persicaria pennsylvanica*).
Smartweed (*Persicaria hydropiper*).
Knotweed (*Polygonum aviculare*).
Black bindweed (*Polygonum convolvulus*).
Climbing false buckwheat (*Tiniaria scandens*).
Lamb's-quarters (*Chenopodium album*).
Rough pigweed (*Amaranthus retroflexus*).
Carpet weed (*Mollugo verticillata*).
Corn cockle (*Agrostemma githago*).
Chickweed (*Alsine media*).
Charlock (*Raphanus raphanistrum*).
Witch hazel (*Hamamelis virginiana*).
Acacia (*Acacia* sp.).
Redbud (*Cercis canadensis*).
Sensitive pea (*Chamæcrista nictitans*).
Partridge pea (*Chamæcrista fascicularis*).
Cassia (*Cassia* sp.).
Lupine (*Lupinus* sp.).
Clover (*Trifolium* sp.).
Trefoil (*Lotus* sp.).
Psoralea (*Psoralea* sp.).
Locust (*Robinia pseudacacia*).
Florida coffee (*Sesban macrocarpa*).
Tick-trefoil (*Meibomia nudiflora* and *M. grandiflora*).
Hairy bush clover (*Lespedeza hirta*).
Creeping bush clover (*Lespedeza repens*).
Bush clover (*Lespedeza violacea*).
Japan clover (*Lespedeza striata*).
Vetch (*Vicia* sp.).
Hog peanut (*Falcata comosa*).

Downy milkpea (*Galactia volubilis*).
Prairie rhynchosia (*Dolicholus latifolius*).
Trailing wild bean (*Strophostyles helveola*).
Pink wild bean (*Strophostyles umbellata*).
Crane's bill (*Geranium carolinianum*).
Yellow sorrel (*Oxalis stricta*).
Croton (*Croton* sp.).
Texas croton (*Croton texensis*).
Three-seeded mercury (*Acalypha gracilens*).
Spotted spurge (*Euphorbia maculata*).
Flowering spurge (*Euphorbia corollata*).
Red maple (*Acer rubrum*).
Box elder (*Rulac negundo*).
Jewel weed (*Impatiens* sp.).
Sida (*Sida spinosa*).
Violet (*Viola* sp.).
Ash (*Fraxinus* sp.).
Morning glory (*Ipomœa* sp.).
Bindweed (*Convolvulus* sp.).
Corn gromwell (*Lithospermum arvense*).
Hoary puccoon (*Lithospermum canescens*).
Gromwell (*Lithospermum officinale*).
Vervain (*Verbena stricta*).
Bastard pennyroyal (*Trichostema dichotomum*).
Ribgrass (*Plantago lanceolata*).
Button weed (*Diodia teres*).
Trumpet creeper (*Campsis radicans*).
Orange hawkweed (*Hieracium aurantiacum*).
Marsh elder (*Iva ciliata*).
Giant ragweed (*Ambrosia trifida*).
Ragweed (*Ambrosia artemisiæfolia*).
Everlasting (*Antennaria* sp.).
Sunflower (*Helianthus* sp.).
Common sunflower (*Helianthus annuus*).
Crownbeard (*Verbesina* sp.).
Beggar ticks (*Bidens* sp.).

MAST AND PINE SEEDS AS FOOD.

Mast, including acorns of the swamp oak (*Quercus palustris*), the white oak (*Q. alba*), beechnuts, the blue beech (*Carpinus caroliniana*), and the chestnut, amounts to 2.47 per cent of the food of the year.

In the pine lands of Florida the bobwhite freely eats the seeds of the long-leaf pine (*Pinus palustris*). Of the 39 birds from Walton County (November, December, and January, 1902 and 1903), 21 had their crops and stomachs mainly filled with this nutritious food. They had usually clipped off the wings of the samaras close to the large seeds. Several crops were full of germinating pine seeds, some of the embryos having cotyledons 2 inches long. In the region about Washington the seeds of the scrub pine (*Pinus virginiana*) also are eaten to a small extent. The fact that these seeds are a good winter food should be remembered by holders of game preserves. Observations show that the key seeds of the maple also are eaten, though much less extensively.

FRUIT AS FOOD.

Unlike the catbird and the cedarbird, whose food consists, respectively, of 50 and 87 per cent of fruit, the food of bobwhite for the year includes only 9.57 per cent of fruit. It is least frugivorous in spring and most so in June and in December and January, taking 20.1 per cent in the summer month and a little over 18 per cent during the two winter months. If more birds collected in June had been available for examination, probably the percentage of fruit would have been lower. The December percentage is evidently characteristic, for it was based on the examination of about 200 stomachs.

In early spring wild winter-cured berries, in May strawberries, later the *Rubus* fruits—thimbleberry, dewberry, and highbush blackberry—and in late summer and autumn an endless profusion of the year's wild harvest yield the bobwhite an accessible and abundant food supply. In late fall and winter, when snow covers the seeds, fruit doubtless keeps it from starving. In December it forms nearly one-fifth of the food for the month. Sumac, wax-myrtle, rose, and bayberry are the main winter supply. Poison-ivy berries are eaten occasionally. Rose hips often project from the snow and furnish timely food. At Falls Church, Va., and at Cabin John Bridge and Marshall Hall, Md., tracks of coveys in deep snow led up to rose shoots to which partly eaten hips were clinging. Sumac and other plants of the genus *Rhus* form 1.60 per cent of the annual food, and during December the proportion of *Rhus* alone is 10.50 per cent. Of 12 birds shot during December at Porters Landing, S. Dak., near the bobwhite's northern limit, by W. C. Colt, each had eaten from 100 to 300 of the carmine sumac berries, and altogether the sumac had furnished 90 per cent of the food they contained. Bayberry and wax-myrtle are as important along the coast as sumacs are inland. Berries of wax-myrtle were found in the stomachs of 15 out of 39 birds collected during November, December, and January, 1902 and 1903, in Walton County, Fla. One hundred and twenty bayberries had been eaten by one bird taken in July, 1901, at Shelter Island, N. Y. Both these fruits last through the winter and well into May, affording excellent provision just when it is most needed.

In spite of its frugivorous tastes and constant association with orchard crops, the bobwhite is not often known to injure cultivated fruits. M. B. Waite reports that near Odenton, Md., it sometimes picks ripening strawberries. Yet birds that were kept in captivity several months refused strawberries when they were hungry. Cultivated cherries were found in a few stomachs, but the bobwhite is not an arboreal feeder and does not damage this crop. During June at Marshall Hall it was repeatedly observed feeding greedily upon the fruit of running dewberry vines. It probably does no serious harm, however, to cultivated bush varieties of *Rubus*, such as the thimbleberry, the raspberry, and the blackberry. It is fond of wild grapes, and a number of crops each contained as many as 25 frost grapes (*Vitis cordifolia*). Hence it might be expected to injure cultivated varieties, for its relative, the California quail, sometimes plunders vineyards; but, so far as the writer knows, vineyards in the East have sustained no appreciable damage from the bobwhite.

In summing up the frugivorous habits of the bobwhite, it may be said that the present investigation shows no appreciable injury to cultivated fruit, but a marked liking for wild fruit. It may be interesting to note, also, that the bobwhite is not nearly so frugivorous as the ruffed grouse.

LIST OF FRUITS EATEN.

Although the percentage of wild fruits yearly consumed is comparatively small, the variety is great, as shown by the appended list, which includes only those actually ascertained to have been eaten. A few careful observers could easily double the number.

Cabbage palmetto (*Inodes palmetto*).
Saw palmetto (*Serenoa serrulata*).
Solomon's seal (*Polygonatum*).
Greenbrier (*Smilax* sp.).
Wax myrtle (*Myrica cerifera*).
Bayberry (*Myrica carolinensis*).
Mulberry (*Morus rubra*).
Sassafras (*Sassafras sassafras*).
Thimbleberry (*Rubus occidentalis*).
High bush blackberry (*Rubus nigrobaccus*).
Dewberry (*Rubus procumbens*).
Strawberry (*Fragaria* sp.).
Rose (*Rosa*).
Haw (*Cratægus* sp.).
Apple (*Malus malus*).
Cultivated cherry (*Prunus* sp.).
Wild cherry (*Prunus serotina*).
Poison ivy (*Rhus radicans*).
Dwarf sumac (*Rhus copallina*).
Staghorn sumac (*Rhus hirta*).
Smooth scarlet sumac (*Rhus glabra*).
Holly (*Ilex opaca*).
Black alder (*Ilex verticillata*).
Climbing bittersweet (*Celastrus scandens*).
Frost grape (*Vitis cordifolia*).
Flowering dogwood (*Cornus florida*).
Sour gum (*Nyssa sylvatica*).
Wintergreen (*Gaultheria procumbens*).
Huckleberry (*Gaylussacia* sp.).
Blueberry (*Vaccinium* sp.).
Ground-cherry (*Physalis pubescens*).
Nightshade (*Solanum nigrum*).
Elder (*Sambucus canadensis*).
Black haw (*Viburnum prunifolium*).
Honeysuckle (*Lonicera* sp.).
Partridge berry (*Mitchella repens*).
Sarsaparilla (*Aralia*).
Woodbine (*Parthenocissus quinquefolia*).

LEAVES AND BUDS AS FOOD.

The bobwhite does not approach the ruffed grouse in destructiveness to leaves, buds, and tender shoots, though occasionally it samples them. It eats the leaves of sorrel sometimes, both yellow sorrel (*Oxalis stricta*) and red sorrel (*Rumex acetosella*). It has been known to take the leaves of cinquefoil (*Potentilla*), and is extremely fond of both red and white clover. Captive birds ate grass, lettuce, and chickweed.

INSECTS AS FOOD.

Notwithstanding statements to the contrary, published and unpublished, the bobwhite eats insects in every month of the year. They form 15.05 per cent of its entire food for the year. From June to August, inclusive, when insects are most numerous, their proportion in the food is 35.97 per cent. The variety of insect food is large.

In the present investigation 116 species have been noted, and further study will doubtless greatly increase the number. Moreover, the large proportion of injurious insects habitually eaten renders the services of this bird more valuable than those of many birds whose percentage of insect food, though greater, includes a smaller proportion of injurious species. Conspicuous among the pests destroyed are the Colorado potato beetle, twelve-spotted cucumber beetle, bean leaf-beetle, squash ladybird, wireworms and their beetle, and May beetles. Its food also includes such weevils as corn billbugs, imbricated snout beetle, clover leaf weevil, cotton boll weevil; also the striped garden caterpillar, army worm, cotton bollworm, and various species of cutworms; also the corn-louse ants, red-legged grasshopper, Rocky Mountain locust, and chinch bug. The bobwhite does not merely sample these species, as do many other birds; it eats some of them in considerable numbers, for crops examined have contained, respectively, a dozen cutworms, an equal number of army worms, 30 Rocky Mountain locusts, and 47 cotton boll weevils. This bird also destroys striped cucumber beetles by the score, potato beetles by the hundred, and chinch bugs in great numbers. From June to August, inclusive, insects and their allies form, as previously mentioned, about a third of the food. Of this beetles make up nearly half, or 15.37 per cent; bugs, 8.54 per cent; caterpillars, 1.37 per cent; grasshoppers, 6.93 per cent; miscellaneous insects, 1.33 per cent, and spiders, with other invertebrates, 2.43 per cent.

BEETLES EATEN.

The beetles most largely destroyed are ground beetles, leaf-eating beetles, and weevils. Naturally, because of the terrestrial habits of the bobwhite, ground beetles, in spite of their vile odor and irritating secretions, are picked up oftener than the other kinds. Experiments with caged birds prove that even the most pungent forms are relished. Ground beetles are numerous in species and superabundant in individuals. One can form no adequate idea of their numbers except at night. Arc lights kill them by thousands. The writer has known one species (*Harpalus pennsylvanicus*) to enter open windows in the evening in swarms. They have an irritating secretion, which if applied to the skin soon raises a blister. Ground beetles are more or less predaceous, hence the whole family was formerly considered beneficial. Later study has resulted in their division into three classes: The most carnivorous species, possessing sharp, curved jaws for capturing and killing other insects; the least predaceous forms, having blunt jaws and eating considerable vegetable matter; and a class intermediate between these two. The first class contains highly beneficial beetles which destroy great numbers of insect pests, while the blunt-jawed class includes some injurious species that feed on crops. Only a few of the bobwhite stomachs examined contained the useful sharp-jawed beetles, but many contained the blunt-jawed species, especially such forms as *Amara* sp., *Agonoderus pallipes*, *Anisodactylus baltimorensis*, *Anisodactylus rusticus*, *Harpalus pennsylvanicus*, and *Harpalus caliginosus*. At Marshall Hall, in August, 1902, a covey of bobwhites was seen greedily eating beetles of the two species of *Harpalus* named above, which were numerous in wheat stubble overgrown by ragweed. The meadow lark, also, was feeding on them. The liking of the bobwhite for *Harpalus pennsylvanicus* was further proved by experiments with caged birds. It eats also the larvæ of these beetles, as do the robin and several other birds. Though the genus *Harpalus* as a whole is useful, destruction of these two species is not amiss, for they injure ripening strawberries by eating out the seeds. Through their depredations on a quarter-acre patch a grower at Leesburg, Va., in three nights lost $350 worth of fruit. The nature of the injury by the beetle has so far made remedial measures impracticable; therefore, the work of the bobwhite and other birds should be estimated at its full value.

Leaf-eating beetles, next in importance after ground beetles in the diet of the bobwhite, include many of the worst beetle pests, and members of the family not already actively injurious are potentially so. These beetles also are provided with protective secretions, more effectively repellant in the larger species, at least, than those of ground beetles, but luckily ineffectual against bobwhite. He eats the most injurious of these insects, such as the potato beetle (*Leptinotarsa decemlineata*), the striped cucumber beetle (*Diabrotica vittata*), the twelve-spotted cucumber beetle (*Diabrotica 12-punctata*), and the squash ladybird (*Epilachna borealis*). The first named is perhaps more correctly termed the Colorado potato beetle. It was a native of the Rocky Mountains originally, feeding on the horse-nettle (*Solanum rostratum*), a plant related to the potato. It began to migrate eastward a year or two before the civil war, and fifteen or sixteen years later reached the Atlantic coast. Since then, as every one knows, this beetle has threatened the potato crop of the country. Birds as a rule avoid it because of its secretions. Therefore the bobwhite's services in destroying it should be highly valued, the more so because the bird's habit of eating the potato bug is not merely occasional nor limited to special localities. Records have come to the Biological Survey from New Jersey, Virginia, Maryland, Iowa, Kansas, Nebraska, Texas, and Ontario; and it is believed that more extended observations will show that the habit is general wherever the birds and the beetles inhabit the same district. During the last week of June, at Marshall Hall, a pair of birds was observed patroling rows of badly infested potato vines and diligently picking off the beetles. Writing of the bird's relation to this insect, C. E.

Romaine, of Crockett, Tex., says: "Quail have built their nests around my fence and even in my garden, within 50 feet of my house. They have kept my potato patch entirely free from the Colorado potato bug." Three captive bobwhites dispatched 50 potato beetles in five minutes, swallowing them whole, apparently with great zest. No food offered them was eaten with more avidity. Thomas McIlwraith says a recent writer mentions that he examined the crop of one which was killed as it rose from a potato patch and found that it contained 75 potato bugs.[a] Lawrence Bruner reports 101 of these beetles found in a single crop.[b] Such wholesale destruction of these pests throughout a large territory is an invaluable aid to agriculture.

The two species of cucumber beetles (*Diabrotica vittata* and *D. 12-punctata*) are highly injurious to cucumbers, squashes, melons, and corn, much of the harm being caused by their larvæ, which feed on the roots of infested crops and are difficult to combat successfully with insecticides. The bobwhite eats them freely without ill effect, though examination seldom reveals them in the stomachs of other birds. Indeed, captive birds of all the other species experimented with have refused them, probably because of their offensive secretions.

To some extent the bobwhite feeds also on certain leaf beetles, known, from their jumping powers, as flea beetles. Its favorites appear to be the three-lined potato beetle (*Lema trilineata*), sometimes an ally of the potato beetle in the potato patch, *Œdionychus fimbriata*, and several members of the genus *Disonycha*. The golden tortoise beetle (*Coptocycla bicolor*), an insect that looks like a drop of molten gold and is an enemy of the sweet potato, is also eaten. The locust leaf-mining beetle (*Odontota dorsalis*) is another victim of the bird. Its larvæ tunnel between the surfaces of locust leaves and kill the foliage. In 1895 the ravages of this pest turned the locust-fringed bluffs on the Potomac below Washington as brown as if touched by fire.

The agriculturist finds weevils hard to cope with, on account of their small size, protective coloration, and retiring mode of life. Birds, however, destroy them in large numbers, often a score or two at a meal, and bobwhite does his share of the work. He often eats two common species that feed on clover leaves (*Sitones hispidulus* and *Phytonomus punctatus*), and preys also on the two billbugs (*Sphenophorus parvulus* and *Sphenophorus zeæ*), the latter injurious to corn. He relishes also that notorious garden pest, the imbricated snout beetle. His most important weevil prey is the Mexican cotton boll weevil (*Anthonomus grandis*). In 1894 this insect first crossed the Mexican border into Texas. During 1903 it caused a loss of

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[a] Birds of Ontario, p. 170, 1894.

[b] Notes on Nebraska Birds, p. 80, 1896.

$15,000,000. Though still chiefly confined to Texas, in time it will undoubtedly occupy the whole cotton belt and do a tremendous amount of harm. The bobwhite is fond of this pest. F. M. Howard, of Beeville, Tex., in writing to the Bureau of Entomology, says that the crops of bobwhites shot at Beeville, Tex., were filled with these weevils.[a] H. G. Wood, of Cuero, Tex., in a letter dated September 21, 1901, relating to the weevil scourge, says:

> Several of our business men and farmers are of the opinion that the quail can be made a vehicle for the destruction of the cotton boll weevil. One farmer reports his cotton fields full of quail, and the entire absence of weevils. He found 47 weevils in the craw of one bird. * * * I claim quail are the greatest insect destroyers of all birds. * * * We propose to prohibit the killing of quail in this county this season, hoping thereby to save a great portion of the cotton crop next season.

The click beetles, the larvæ of which are the wireworms so inimical to corn and other plants of the grass family; *scarabæid* beetles, though in smaller numbers; dung beetles, when numerous, and May beetles, parents of the injurious white grub, are eaten by the bobwhite. The May beetle (*Lachnosterna* sp.) and its near relative, *Ligyrus gibbosus*, were eagerly eaten by captive birds. The useful ladybirds (*Coccinellidæ*) are sometimes found in the bird's crop, but, judging from experiments with caged birds, do not appear to be highly relished. *Adalia bipunctata* was several times offered and refused, but was finally eaten. The one harmful beetle of the family, the squash ladybird (*Epilachna borealis*), has been found in stomachs and was relished by captive birds. Certain miscellaneous beetles belonging to different families are occasionally picked up, such as rove beetles, soldier beetles, darkling beetles, histerid beetles, and longicorn beetles.

LIST OF BEETLES EATEN.

The beetles known to be eaten by the bobwhite include the following:

GROUND BEETLES (Carabidæ):
- *Scarites subterraneus.*
- *Amara* sp.
- *Casnonia pennsylvanica.*
- *Platynus extensicollis.*
- *Agonoderus pallipes.*
- *Harpalus pennsylvanicus.*
- *Harpalus caliginosus.*
- *Anisodactylus rusticus.*
- *Anisodactylus baltimorensis.*

LEAF BEETLES (Chrysomelidæ):
- *Lema trilineata.*
- *Cryptocephalus venustus.*
- *Colaspis brunnea.*

LEAF BEETLES—Continued.
- *Nodonota tristis.*
- *Leptinotarsa decemlineata* (potato beetle).
- *Chrysomela pulchra.*
- *Chrysomela suturalis.*
- *Cerotoma trifurcata* (bean leaf-beetle).
- *Diabrotica vittata* (striped cucumber beetle).
- *Diabrotica 12-punctata* (twelve-spotted cucumber beetle).
- *Œdionychis fimbriata.*
- *Disonycha 5-vittata.*

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[a] Circular 27, new series, Division of Entomology, p. 6, 1897.

Leaf Beetles—Continued.
- *Disonycha xanthomelæna.*
- *Disonycha crenicollis.*
- *Psylliodes punctulata.*
- *Microrhopala vittata.*
- *Odontota dorsalis* (locust leaf-mining beetle).
- *Coptocycla bicolor* (golden tortoise beetle).

May Beetles (Scarabæidæ):
- *Onthophagus pennsylvanicus* (dung beetle).
- *Aphodius inguinatus* (dung beetle).
- *Serica* sp.
- *Diplotaxis* sp. (leaf-chafer).
- *Lachnosterna tristis* (May beetle).
- *Anomala* sp.
- *Aphonus* sp.

Snout Beetles (suborder Rhynchophora):
- *Thecesternus humeralis.*
- *Epicærus imbricatus* (imbricated snout beetle).
- *Tanymecus confertus.*
- *Aramigus fulleri* (Fuller's rose beetle).
- *Sitones hispidulus* (clover weevil).
- *Phytonomus punctatus* (clover-leaf weevil).

Snout Beetles—Continued.
- *Anthonomus grandis* (Mexican cotton boll weevil).
- *Chalcodermus collaris.*
- *Centrinus* sp.
- *Sphenophorus parvulus* (billbug).
- *Sphenophorus zeæ* (corn billbug).

Click Beetles (Elateridæ):
- *Drasterius elegans.*
- *Agriotes* sp.
- *Melanotus communis.*
- *Corymbites* sp.

Ladybirds (Coccinellidæ):
- *Hippodamia parenthesis.*
- *Coccinella sanguinea.*
- *Adalia bipunctata.*
- *Epilachna borealis* (squash ladybird).

Histerid Beetles (Histeridæ).

Darkling Beetles (Tenebrionidæ):
- *Blapstinus.*

Rove Beetles (Staphylinidæ).

Soldier Beetles (Lampyridæ):
- *Chauliognathus pennsylvanicus.*

Longicorn Beetles (Cerambycidæ):
- *Tetraopes tetraophthalmus.*

BUGS EATEN.

The bobwhite eats comparatively more bugs than most birds, including both *Heteroptera*, or true bugs, and *Homoptera*, which form 2.77 per cent of its food. The maximum number of bugs was taken in August and amounted to 21.1 per cent of the food for that month.

The chinch bug, which in this country has destroyed over $100,000,000 worth of wheat and other cereals in a season, is preyed upon by the bobwhite throughout the year. C. V. Riley says: "In the winter time, when hard pushed for food, this bird must devour immense numbers of the little pests, which winter in just such situations as are frequented by the quail; and this bird should be protected from the gun of the sportsman in every State where the chinch bug is known to run riot."[a] The data possessed by the Biological Survey concerning this species are scanty, but they show that the quail destroys the pest in Ohio, Indiana, Illinois, Missouri, Kansas, and Nebraska. The number of chinch bugs eaten varies, but usually appears to be large. Thus a bird shot October 12, 1901, at Badger, Nebr., by W. C. Colt, had picked up 100, and the American Field for February

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[a] Missouri Reports, II, p. 28, 1870.

21, 1903, reports that an observer at Seymour, Ind., found a teaspoonful in a crop. In a letter to the Department of Agriculture, M. A. Page, of Garnett, Kans., says of a bobwhite: "On opening the crop we found about two tablespoonfuls of chinch bugs."

The bobwhite also destroys the false chinch bug (*Nysius angustatus*), which attacks grapes, strawberries, apples, potatoes, turnips, radishes, beets, and cabbages. It eats the tarnished plant bug (*Lygus pratensis*), injurious to fruit and truck crops, and stink bugs of more than a dozen species, one (*Euschistus variolarius*) being a pest on many garden vegetables. The noninjurious species, particularly *Thyanta custator*, are often eaten, one bird containing 30 of them. More *Homoptera* (leaf hoppers and other forms) are eaten by bobwhite than by most other birds. The little leaf hopper (*Oncometopia lateralis*) is especially relished.

LIST OF BUGS EATEN.

Heteroptera:
- *Blissus leucopterus* (chinch bug).
- *Nysius angustatus* (false chinch bug).
- *Euschistus tristigmus* (three-spotted soldier bug).
- *Euschistus variolarius*.
- *Euschistus* sp.
- *Podisus* sp.
- *Brochymena* sp.
- *Nezara hilaris*.
- *Mormidea lugens*.
- *Hymenarcys nervosa*.
- *Hymenarcys æqualis*.
- *Thyanta custator*.
- *Œbalus pugnax*.
- *Trichopepla semivittata*.

Heteroptera—Continued.
- *Cœnus delius*.
- *Peribalus limbolarius*.
- *Lygus pratensis* (tarnished plant bug).
- *Corimelœna* sp.
- *Apiomerus crassipes*.
- *Alydus eurinus*.
- *Corizus* sp.
- *Euthoctha galeator*.
- *Scutelleridæ* (shield-backed bugs).

Homoptera:
- *Oncometopia lateralis*.
- *Oncometopia* sp.
- *Deltocephalus* sp.
- *Diedrocephala* sp.

GRASSHOPPERS AND ALLIED INSECTS EATEN.

Grasshoppers with a few crickets make 3.71 per cent of the yearly food. In September they contribute 11.9 per cent. The walking stick, singularly like a twig and at times very numerous and injurious to foliage of shade and forest trees, has been found in the stomach of the bobwhite. Locusts and meadow grasshoppers, both highly destructive to vegetation, are favorite articles of diet. The bird grasshopper, so called from its size, is occasionally eaten. The destructive grasshoppers or locusts of the genus *Melanoplus*, such as *M. atlanis*, *M. femur-rubrum*, or the red-legged grasshopper, and the Rocky Mountain locust, form the bulk of the orthopterous food of the species. The Rocky Mountain locust is one of the worst of insect pests, and its appearance in large numbers is a calamity. It appears in swarms, clouding the sun and covering the earth, sweeping every green thing before it, and often driving the farmer from home and threatening him with starvation. During a single season it has caused a loss of $100,000,000.

In 1874–75 Samuel Aughey made a special study of a Nebraska invasion and found that the bobwhites were an active enemy of the locusts. Of 21 birds shot between May and October, inclusive, all but five had fed on locusts. The smallest number taken by any bird was 20 and the largest 39; in all, 539—an average of 25 apiece. C. V. Riley ascertained that the bird feeds also on the eggs of the locust, particularly in winter, when they are exposed by the freezing and thawing of the ground. If every covey destroyed as many locusts in a day as the one just referred to, it is hard to overestimate the usefulness of the bobwhite where abundant in infested regions.

The following are a few of the many species of orthopterous insects identified from the crops and stomachs of bobwhites:

Cricket (*Gryllus* sp.).
Meadow grasshoppers (*Xiphidium, Orchelinum, Scudderia*).
Katydid (*Microcentrum* sp.).
Walking sticks (*Phasmidæ*).
Grouse locust (*Tettix* sp.).
Mountain locust (*Melanoplus spretus*).
Red-legged grasshopper (*Melanoplus femur-rubrum*).
Grasshopper (*Melanoplus bivittatus, M. scudderi, M. atlanis*).
Bird grasshopper (*Schistocerca americana*).

CATERPILLARS EATEN.

The bobwhite seems to eat fewer caterpillars than would be expected from its terrestrial habits. The yearly proportion only formed 0.95 per cent and the maximum quantity eaten in a month was 4 per cent in May. This apparent neglect of caterpillars as food is perhaps due to their scarcity where the birds for the present study were shot. Pupæ and adult moths occasionally serve as food. Whatever the list of species of caterpillars eaten by bobwhite lacks in length it makes up in importance, for so great a proportion of serious lepidopterous pests is seldom found in the fare of any bird. As is true of some other birds, the bobwhite includes the army worm in its bill of fare. This pest sometimes exists in legions and moves steadily forward from field to field, devouring corn, oats, forage, and other crops. Fortunately it is not often active, and the years of its occurrence are frequently separated by long intervals. Every year, however, the different species of cutworms do serious damage. They cut down germinating grain, often before the plants have fairly sprung above ground. Owing to their mode of feeding, a few worms may lop off many plants in a night. It seems strange that the bobwhites find as many of these nocturnal larvæ as they do. The cotton worm, a pest so destructive that in one year it has caused a loss of $30,000,000 to the cotton fields, is preyed upon by the bobwhite. Tobacco worms were sparingly eaten by bobwhites at Marshall Hall, but experiments indicated that they may eat them in greater numbers when opportunity offers. Five tobacco worms (*Phlegethontius sexta*), two-thirds grown, placed in a cage with three captive bobwhites, July 8, 1903, were devoured in less than two minutes. Cabbage worms (*Pontia rapæ*) and cutworms also were offered and greedily eaten.

LIST OF CATERPILLARS EATEN.

Army worm (*Heliophila unipuncta*).
Cutworm (*Agrotis* sp.).
Cutworm (*Feltia annexa*).
Noctuid moth (*Noctuidæ*).
Cotton worm (*Alabama argillacea*).
Cotton bollworm (*Heliothis obsoleta*).
Striped garden caterpillar (*Manestra legitima*).
Yellow bear caterpillar (*Diacrisia virginica*).
Pyralid (*Tholeria reversalis*).
Purslane sphinx (*Deilephila gallii*).
Southern tobacco worm (*Phlegethontius sexta*).
Caterpillar (*Junonia cœnia*).
Pupa (*Vanessa* sp.).

Miscellaneous Animal Food.

Insects of several orders not previously mentioned make up 0.70 per cent of the food of the bobwhite. They include hymenopterous insects, such as ants (*Lasius* sp., *Tetramorium cæspitum*, *Camponotus pennsylvanicus*); gall flies (*Cynipidæ*), which produce bladderlike growths on plants; in rare instances parasitic wasps (*Tiphia inornata* and *Proctotrypes rufipes*); crane flies, May flies, and sometimes true flies, like the green fly (*Lucilia cæsar*) and the robber fly (*Asilidæ*). The animal food of the bird includes other orders besides insects. The greater part of this is spiders, chiefly ground spiders, with a few harvest spiders (*Phalangidæ*). The common thousand leg (*Julus* sp.) sometimes contributes to the food, as it often does to that of many species of song birds. Snails are more often taken. Among these *Pupa armifera* and the pond snail (*Succinea avara*) have been identified. The little fresh-water lobster called crayfish (*Cambarus*) had furnished the major course for 4 out of 15 birds shot by collectors for S. A. Forbes in Illinois. Manipulation of these biting crustaceans would appear to be difficult for a bird no larger than bobwhite. The queerest food eaten is the toad. B. H. Warren reported Florida birds as feeding on small batrachians (probably young toads), and laboratory examination of Florida birds showed in one case a tiny toad. It is fortunate that this habit of bobwhite is not general, since the toad is useful and destroys great numbers of insects.

Food of the Young.

During the breeding season a third of the food of adult bobwhites consists of insects, while their young, like those of practically all other land birds, consume a much greater proportion of insect food than do their parents. At Marshall Hall, July 24, 19 droppings collected from two broods of downy chicks—one but a few hours out of the shell and the other probably several days old—consisted wholly of the remains of insects. Their fragmentary condition made the species almost unrecognizable, but the following were identified:

Minute green leaf-eating beetles (*Chrysomelidæ*), at least two species.
Leaf-eating beetle (*Colaspis brunnea*).
Small scarabæid beetles (*Scarabæidæ*), two species.
Longicorn beetle (*Cerambycidæ*), one species.
Ground beetles (*Carabidæ*), five species.
Weevils (*Rhynchophora*).
Grasshopper (*Acrididæ*).
Caterpillars (*Lepidoptera*).
Ants (*Formicidæ*).
Stink bug (*Euschistus?*).
Spiders (*Arachnida*).
Thousand legs (*Julus* sp.).

MASKED BOBWHITE.

(*Colinus ridgwayi.*)

The masked bobwhite is slightly smaller than the bobwhite of the Eastern States, and the male differs strikingly, having the chin, throat, and sides of the head black, and the underside of the body usually uniform rusty reddish. Since the discovery of the bird little has been added to our knowledge of its life history beyond some notes on its distribution, and the fact of its probable extinction within our borders. It lived on grassy plains covering a limited area in southern Arizona, south and southwest of Tucson, and ranged into northern Sonora, Mexico. In regard to the causes leading to the disappearance of the masked bobwhite, Herbert Brown writes as follows:

> The causes leading to the extermination of the Arizona masked bobwhite (*Colinus ridgwayi*) are due to the overstocking of the country with cattle, supplemented by several rainless years. This combination practically stripped the country bare of vegetation. Of their range the *Colinus* occupied only certain restricted portions, and when their food and shelter had been trodden out of existence by thousands of hunger-dying stock, there was nothing left for poor little bobwhite to do but go out with them. As the conditions in Sonora were similar to those in Arizona, birds and cattle suffered in common. The Arizona bobwhite would have thriven well in an agricultural country, in brushy fence corners, tangled thickets, and weed-covered fields, but such things were not to be had in their habitat. Unless a few can still be found on the Upper Santa Cruz we can, in truth, bid them a final good-by.[a]

Recent information received by the Biological Survey from Sonora is to the effect that these interesting birds still survive in parts of that region, and efforts are being made by a game association to obtain living birds from there to introduce into California. The natural home of the masked bobwhite, in the hot and arid desert of southern

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[a] Auk., XXI, p. 213, April, 1904.

Arizona and northern Sonora, is sufficient guaranty that the birds would thrive in cultivated sections anywhere in southern California and the arid Southwest. It would be deplorable if so handsome and useful a bird should be allowed to become extinct, and a determined effort should be made to introduce it into suitable localities before it is too late.

Beyond what Herbert Brown has stated we have practically nothing on this bird's habits. He has told us that, like all the birds of the genus *Colinus*, the males give the well-known ' bobwhite ' call, and he translates their rallying note as ' hoo-we.' He examined the stomachs of three birds. The first contained mustard seed, chaparral berries, six or eight beetles, and other insects; the second only a single grasshopper an inch long, and the third contained 20 ants, several crescent-shaped seeds, and a large number of small, fleshy green leaves.

It is stated by Bendire that in Sonora Benson found these birds only in fields where wheat and barley had been grown. Probably then the bird's general habits may be safely assumed to be similar to those of its relative, bobwhite.

CALIFORNIA QUAIL.

(*Lophortyx californicus.*)[a]

The California quail is generally dispersed over California below an altitude of 8,000 feet and extends into southern Oregon and western Nevada. It has been introduced into Washington and British Columbia, and efforts to introduce it into the Hawaiian Islands also have proved very successful, although of late years its numbers there have been much reduced by the mongoose, by which in time it is likely to be exterminated. Two geographic forms of the bird are recognized, a dark form and a light one, but as they do not differ in habits they are not distinguished in the following account. It is a beautiful bird with a most pleasing combination of colors and markings, its head being adorned by a glossy black crest, narrow at the base and gradually widening into gracefully recurving plumes, and the markings on the underparts resembling scales. It frequents brush-covered hillsides, canyons, thickets along water courses and the borders of roads, as well as vineyards and other cultivated fields. The nesting time of the species varies considerably according to locality and conditions. According to E. A. Mearns it nests in March and April in Ventura County, Cal. Nests containing eggs were found during the last week of May in Tulare County, Cal., by J. E. McLellan. The eggs usually number 12 to 15, and are white or buff with spots.

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[a] This name is used here to cover both the typical California quail (*Lophortyx californicus*) and the paler, more southerly form, called the valley quail (*L. c. vallicola*).

These birds take kindly to civilization, and flocks are not rarely seen in the suburbs of large towns, where they range through the gardens and orchards. They often nest close to farm buildings, and W. Otto Emerson states that a pair nested within a rod of his front door, though nearly every hour people and vehicles were passing within four feet of the nest.

Instead of spending the night in a circle on the ground, like the bobwhite, the California quail chooses much safer places and roosts in bushes or low thickly foliaged trees. This quail is even more confiding than the bobwhite, and frequently comes about farm buildings to eat with the chickens. It has been known to lay in confinement, and appears to yield readily to semidomestication.

The valley quail has acquired the interesting habit of posting sentinels when feeding, which is described in detail by John J. Williams. Mr. Williams observed a flock enter a field and begin to feed, while a sentinel took his station in a peach tree and scanned the country round about for danger. Presently he was relieved by a second bird, who took up a position on a brush pile and a little later was relieved by a third, who kept guard while the other two fed with the flock.[a]

Writing in 1891 Clark P. Streator says that about 100,000 are sold each year in the San Francisco market. It is not a perfect game bird, for it does not lie well to a dog, and when once flushed has a habit of running that is exasperating to the sportsman. The best way to hunt these quail is to keep the dog at heel and to run down the birds. This is likely to make them take wing and to break up the covey. The same result may be accomplished also by discharging the gun in the air. When a covey has been scattered in suitable cover they will lie well enough to a trained dog to give the hunter considerable sport, though it is poor in comparison with that afforded by the bobwhite. The beauty of this quail, its pleasant call notes, and its confidence in man make it a favorite, except where it damages the grape crop. In fall and winter where it is abundant hundreds of birds unite in great packs. Bendire, writing in 1892, says that within a decade packs of 500 were often found, but that at that time coveys even of 50 were rare in most places.[b] In the fall of 1891 they were still very abundant on the west side of the San Joaquin Valley, where E. W. Nelson, of the Biological Survey, records their slaughter by pot hunters. The hunters stationed themselves behind a brush blind near the one spring where the birds came to drink. Thousands of them flocked thither for water during the day, and by waiting until many birds were bunched the hunters killed at least a score at each discharge of the gun. In a week of this butchery 8,400 quails were killed. A record of 525 birds to four guns in a day in February, 1903, near San Diego, Cal., shows that birds are still abundant there, though far less numerous in most places than formerly.[a]

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[a] Condor, vol. 5, pp. 146–148, 1903.

[b] Life Hist. N. Am. Birds [I], p. 24, 1892.

The California quail, though not a large consumer of insects, is a useful bird, since weed seeds constitute more than half of its food. In some regions these birds suffer from the curtailment of their food supply by droughts, and in the northern part of their range many are killed by severe winters. Bendire states that during the excessively cold winter of 1887–88, when the mercury dropped to 28° below zero in the northeastern corner of California, these quail perished in great numbers.[b]

The California quail might be introduced successfully in many sections between California and Texas where it does not occur at present. It already has been introduced into Colorado, where it will be protected by law at all seasons until 1920. Laws to prevent trapping and to limit the day's bag, together with absolute protection in sections where necessary, should suffice to preserve this beautiful species.

FOOD HABITS.

The general food habits of this quail have been ascertained by the examination of 601 stomachs, and it proves to be one of the most largely vegetarian of game birds. The material for investigation was collected in California, and represents every month of the year except May. Insects furnished but 2.15 per cent of the food, and leaves, seeds, and fruit 97.85 per cent.

INSECT AND OTHER ANIMAL FOOD.

The 2.15 per cent of animal food eaten by this quail is distributed as follows: Spiders, 0.03 per cent; beetles, 0.22 per cent; grasshoppers and crickets, 0.24 per cent; ants and other Hymenoptera, 0.67 per cent; miscellaneous insects, 0.99 per cent. The beetles are both adults and larvæ, and belong to the following families: *Chrysomelidæ* (leaf-eating beetles), *Tenebrionidæ* (darkling beetles), *Elateridæ* (wireworms), *Carabidæ* (ground beetles), *Dermestidæ* (dermestids), *Coccinellidæ* (ladybirds), and snout beetles (suborder *Rhynchophora*). The leaf-eating beetles include *Diabrotica soror*, a western representative of the destructive twelve-spotted cucumber beetle. Flea beetles also are eaten, including species of the genus *Haltica*. Among the miscellaneous leaf-eating beetles may be mentioned the brilliant *Gastroidea cæsia.* Conspicuous among the ground beetles eaten is the common *Agonoderus pallipes*, and among the useful predaceous ladybirds the species *Hippodamia convergens.* Like the eastern bobwhite, the California quail feeds on ants of the families *Formicidæ* and *Myrmicidæ.* Sometimes 20 to 35 ants are taken at a meal. Of the other Hymenoptera, gall insects (*Cynipidæ*) and their galls make a significant proportion. Caterpillars and their pupæ are eaten. Cutworms (*Agrotis*), measuring worms (*Geometridæ*), sphinx caterpillars (including *Deilephila*), and the cotton bollworm (*Heliothis obsoleta*) make up the greater part of this food. Like the bobwhite again, this bird shows a relish for bugs. It eats leaf bugs (*Capsidæ*), bugs of the chinch bug family, such as *Lygæus truculentis* and *L. bitriangularis*, and stink bugs (*Pentatomidæ*), assassin bugs (*Reduviidæ*), flat bugs (*Aradidæ*), burrower bugs (*Crytomenus*), leaf hoppers (*Jassidæ*), tree hoppers (*Membracidæ*), plant lice, and bugs of the genus *Scolops* (*Fulgoridæ*). The miscellaneous animal matter taken includes flies (*Lucillia cæsar*), spiders, and snails.

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[a] Recreation, vol. 18, p. 368, 1893.

[b] Life Hist. N. Am. Birds [I], p. 26, 1892.

VEGETABLE FOOD.

FRUIT.

The vegetable food of this quail amounts to 97.85 per cent of its diet. The bird has an unsavory reputation among fruit growers, especially the owners of vineyards. Relative to this subject, Miss Florence A. Merriam, writing from San Diego County, Cal., says:

> In fact, the quail were so abundant as to be a pest. For several years great flocks of them came down the canyons to Major Merriam's vineyard, where they destroyed annually from twenty to thirty tons of fruit. In one season—July to October, 1881—one hundred and thirty dozen [1,560] were trapped on his ranch. The result of this wholesale destruction was manifest when I returned to the valley in 1894. The birds were then rarely seen on the roads and seldom flushed in riding about the valley.[a]

When this species becomes superabundant and plays havoc with crops it is well to remember that it can be so easily checked. W. H. Osgood, of the Biological Survey, has furnished the writer data on the frugivorous habits of the quail in central California. In one vineyard he saw a flock of about a thousand eating zinfandel grapes. The birds do much damage in September, when the young are molting and they have collected in packs, as before described.

Walter E. Bryant, writing of the damage to fruit, offers testimony on the other side:

> In some parts of California there is a strong prejudice against the quail, owing to alleged damage to the grape. The evidence which I have thus far gathered shows that the quail do pick at the bunches of grapes, and not alone

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[a] Auk, XIII, p. 116, 1896.

those bunches which are near or on the ground; but the damage which they cause seems overestimated. Too often mutilated bunches of grapes are supposed to be due to the presence of quail in the vineyard; but there are other birds and mammals, also, which vary their diet with grapes. I have examined a number of quail's crops and gizzards without finding the presence of grapes, although the birds had been shot near and in vineyards. A quail's crop sent to me from Los Gatos, by Mr. A. H. Hawley, contained twenty-five small grapes; others had a few grapes, seeds, and poison-oak berries.[a]

In the 601 stomachs of the valley quail examined by the Biological Survey grapes formed only 0.01 per cent of the annual food. This small quantity is due, no doubt, to the fact that many of the birds were shot in regions remote from vineyards and many of them during the time when grapes were not in fruit. The total proportion of all kinds of fruit was only 7.60 per cent, an amount so insignificant as to preclude the idea of serious damage. Where the birds are overabundant and the consequent damage great, trapping or advertising the conditions in sporting papers will probably result in reducing the numbers to normal. Of the 7.60 per cent of fruit, grapes, as before stated, contribute 0.01 per cent; plants of the genus *Rhus*, mainly *Rhus diversiloba*, 4.74 per cent, and miscellaneous fruit, prunes, and vaccinium, 2.85 per cent. The maximum quantity of fruit, amounting to 32.40 per cent for the month, was taken in December, after the grapes had been picked.

GRAIN.

The relations of the California quail to grain are of considerable economic importance. W. T. Craig, of San Francisco, writes to the Department of Agriculture: "I have observed the quail enter a field of wheat to the number of thousands, and had they not been driven away they would have destroyed the whole crop." No other reports to the Biological Survey show the danger to grain from this quail to be so serious, but data at hand show that it does more or less damage to germinating grain. Two quail shot by Walter E. Bryant on a newly-sown grain field had eaten, respectively, 185 kernels and 210 kernels of barley.[b] Barley is important in California, where it is grown for hay, for grain feed, and for beer making. There is, however, much volunteer barley, which many species of birds feed on and thus do good rather than harm. It is probable that quail do little or no harm to barley at harvest time, and the waste grain that they subsequently gather in stubble fields has no positive value. Of the yearly food of the 601 quail examined 6.18 per cent was grain, divided as follows: Barley, 4.58 per cent; wheat, 0.44 per cent; corn and oats, 1.16 per cent.

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[a] Zoe, IV, p. 56, 1893.

[b] Zoe, IV, p. 55, 1893.

LEAVES.

In its habit of feeding on foliage the California quail differs from the bobwhite and resembles the ruffed grouse. Such food forms 22.73 per cent of the vegetable matter eaten. In February, when the bobwhite is weathering blizzards, the California quail is enjoying balmy weather and feeding on browse to the extent of 80 per cent of its food. Most of this browse consists of leaves of leguminous plants, principally clovers. Bur clover (*Medicago denticulata*), a weed that grows in cultivated land and along irrigation ditches, appears to supply most of the forage. Alfalfa and clovers of the genus alfalfa form most of the remaining leguminous green food. Next to legumes the finely divided leaves of alfilaria, or 'filaree' (*Erodium*), are important. Grass, chickweed (*Alsine media*), the leaves of fern, geranium, oxalis, and groundsel-bush (*Baccharis*) also furnish forage for the quail. W. W. Cooke reports that near Grand Junction, Colo., where the California coast quail has been introduced and thrives wonderfully, market gardeners regard it as a nuisance.[a]

WEED SEEDS.

Different seeds, largely of weeds, furnish the California quail 59.77 per cent of its year's diet. Legumes contribute 17.87 per cent; alfilaria, 13.38 per cent; compositæ, 5.55 per cent; the spurge family (*Euphorbiaceæ*), 5.85 per cent, and miscellaneous plants 17.12 per cent. Leguminous seeds are liked best by the bird, and make up 17.87 per cent of the seed diet for the year and 46.1 per cent of its food for June. Bur clover yields abundance of seeds as well as forage. Its seed pod is peculiar, much elongated, beset with long, sharp spines, and spirally coiled into a roundish bur. The quail swallows it whole, regardless of spines. This food is highly nutritious and is relished by stock as well as by birds and wild mammals. Seeds of closely allied plants, such as alfalfa, vetch, cassias, cultivated beans and peas, and clovers of the genera *Trifolium*, *Lespedeza*, and *Melilotus* also are in the quail's list, as well as of locust (*Robinia*) and lupines, the latter taken in large quantities. They include the seeds of *Lupinus nanus*, *L. micranthus*, and *L. sparsiflorus*. Other leguminous seeds are eaten in great numbers, including a small beanlike seed, *Lotus glaber*, which looks much like a miniature Frankfurt sausage, and an unidentified, almost microscopic square seed, with a notch in its edge, possibly some species of birdsfoot trefoil (*Lotus*). Nearly all of the leguminous plants that furnish the quail with seeds belong in the category of weeds.

Seeds of weeds from other families of plants make up no less than

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[a] Birds of Colorado, App. 2, p. 202, 1900.

41.89 per cent of the annual food. Seeds of compositæ yield 5.55 per cent, such injurious weeds as thistles making up the largest part of this percentage. The thistles most often eaten are *Centaurea melitensis*, *C. americana*, *C. solstitialis*, *Mariana mariniana*, *Sonchus* sp., and *Carduus* sp. *M. mariniana* has the largest seeds. Ninety of these had been eaten by a quail shot by F. E. L. Beal at Haywards, Cal., August 15, 1903. The seeds of the bur thistle (*Centaurea melitensis*) are smaller and have a hook at one end and a set of spines like a paint brush at the other. They are, perhaps, most liked of all composite seeds. From 500 to 800 are often eaten at a meal. The destruction of this seed is highly beneficial, for the bur thistle is troublesome to farmers. Wild carrot (*Daucus carota*), tar weed (*Madia sativa*), wild lettuce (*Lactuca* sp.), mayweed (*Anthemis cotula*), and marsh elder (*Iva xanthifolia*) furnish most of the remaining seeds of composite plants. Tar weed is a favorite source of food, and one stomach, collected at Watsonville, Cal., by J. S. Hunter, contained 700 of these seeds. Another stomach, from the same place, held 2,000 tiny seeds of dog fennel, or mayweed. (Fig. 4.)

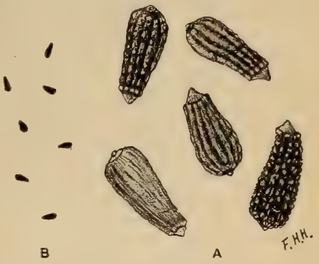

FIG. 4.—Seed of mayweed (*Anthemis cotula*). (From Bull. 38, Nevada Agricultural Experiment Station.)

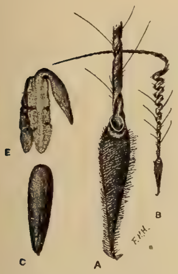

FIG. 5.—Seed of alfilaria (*Erodium cicutarium*). (From Bull. 38, Nevada Agricultural Experiment Station.)

From seeds of plants belonging to the spurge family (*Euphorbiaceæ*) come 5.85 per cent of the annual food. Spurges, particularly *Croton setigerus*, commonly known as turkey mullein, are a staple with the California quail as with most other seed-eating birds. So fond are the quail of turkey mullein that their crops are often completely distended with the seeds, sometimes from 500 to 900 to a bird. Turkey mullein is a prostrate plant covered with a whitish, woolly pubescence, and often used by the Indians to poison fish. Seeds of alfilaria (*Erodium cicutarium* and other species), which is both a weed and a forage plant, are eagerly sought. They are lance-shaped, furnished with a long, elaborate, corkscrew awn ending in a thin spine. They burrow into sheep's wool and even pierce the skin. The alfilaria is one of the few seeds of the West that all seed-eating birds consume. The plant is very

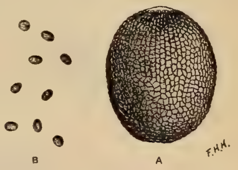

FIG. 6.—Seed of black mustard (*Brassica nigra*). (From Bull. 38, Nevada Agricultural Experiment Station.)

abundant in California, and the quail often eats from 1,000 to 1,600 of the little corkscrew seeds at a meal. It affords 13.38 per cent of the year's food, and 26.70 per cent of the June diet. (Fig. 5.)

Seeds of miscellaneous weeds comprise 17.11 per cent of the annual food. Among the species included are pigweed (*Chenopodium album*), rough pigweed (*Amaranthus retroflexus*), and black mustard (*Brassica nigra*) (fig. 6)—especially obnoxious in grain fields—and the closely related weed, wild radish (*Raphanus sativus*). Seeds of shepherd's purse (*Bursa bursa-pastoris*) and of other cruciferous plants are included in common with *silene* and the chickweeds (*Cerastium* sp. and *Alsine media*) (fig. 7). Geranium seeds (fig. 8) are so much relished that often 300 or 400 are eaten at a time. Two closely related plants, miner's lettuce (*Montia perfoliata*) and red maids (*Calandrinia menziesii*), bear minute shiny black seeds that often are eaten by the thousand. The little seeds of red sorrel (*Rumex acetosella*) (fig. 9) and curled dock (*Rumex crispus*) are occasionally taken in almost as large numbers. Seeds of chess (*Bromus*

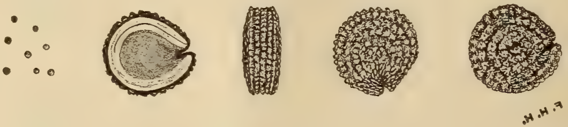

Fig. 7.—Seed of chickweed (*Alsine media*). (From Bull. 47, Nevada Agricultural Experiment Station.)

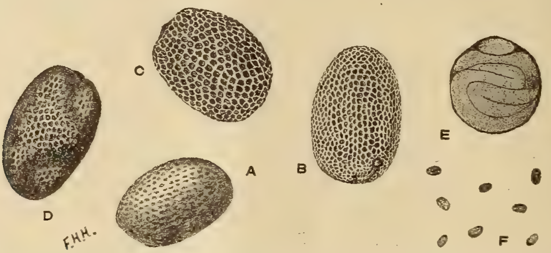

Fig. 8.—Seed of *Geranium dissectum*. (From Bull. 47, Nevada Agricultural Experiment Station.)

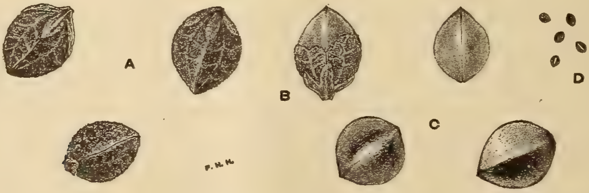

Fig. 9.—Seed of sorrel (*Rumex acetosella*). (From Bull. 47, Nevada Agricultural Experiment Station.)

secalinus (fig. 10) and *Bromus hordeaceus*), a serious grain pest, are relished, and hundreds of the grain-like seeds of the grass known as 'poison darnel' (*Lolium temulentum*) appear in crops examined. Macoun, quoting Spreadborough, states that in British Columbia, where it winters successfully, the quail finds shelter in severe weather under the broom (*Cytisus scoparius*), which in places grows abundantly and yields seed for subsistence.[a]

The quail feeds also at times on mast. A. K. Fisher, in the western foothills of the Sierra Nevada, the last of July found both young and adult quail eating young acorns.[b] Small quantities of sedge seeds (*Carex* and *Scirpus*) and of dodder (*Cuscuta*) are eaten, the latter plant being a destructive parasite on leguminous forage crops. The miscellaneous seed list includes also stick seeds (*Lappula* sp.), buttercup (*Ranunculus* sp.), bind weed (*Convolvulus* sp.), *Amsinckia* sp., *Anagallis arvensis*, plaintain (*Plantago major*), ribgrass (*Plantago lanceolata*), painted cup (*Castilleja* sp.), mountain lilac (*Ceanothus* sp.), and black wattle (*Callicoma serratifolia*). In the mountains of Lower California the food supply determines the breeding time of birds. If there is not enough rain for a good supply of seeds the coveys of quail do not break up into nesting pairs but remain in coveys throughout the summer. If the season is wet and the winter rains promise abundant food the birds mate in March and begin nesting immediately.[c]

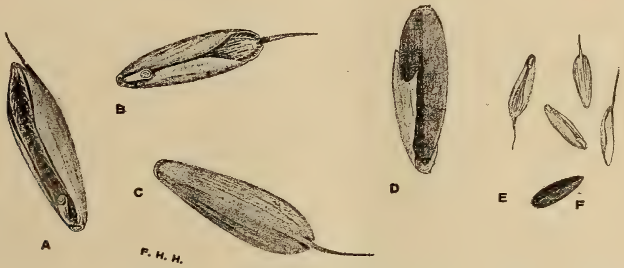

Fig. 10.—Seed of chess (*Bromus secalinus*). (From Bull. 47, Nevada Agricultural Experiment Station.)

Food of the Young.

The food of young birds differs from that of the parents, as has already been remarked of the bobwhite, but the difference is less marked with the California quail. Stomachs of 32 young of the western birds, from one-fourth to one-half grown, have been examined. They were collected from the middle of July to the middle of September. The food was composed of 3.4 per cent animal matter and 96.6 per cent vegetable matter. Thirty-nine adult birds shot in the same period had eaten almost entirely vegetable food, since only 0.6 per cent of animal food appeared in analysis. Had the young birds been collected when newly hatched, undoubtedly a larger proportion of insect food would have been found. The 3.4 per cent of insect food mentioned consisted of beetles, 0.1 per cent; bugs, 0.2 per cent; grasshoppers, 1.3 per cent, and ants, 1.8 per cent.

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[a] Cat. Can. Birds, Part I, p. 198, 1900.

[b] N. A. Fauna, No. 7, p. 28, 1893.

[c] Life Hist. N. A. Birds [I], p. 27, 1892.

The vegetable food of the young is much like that of the adult. In this case it consisted of leguminous seeds, 18.1 per cent; alfilaria seeds, 18.5 per cent; miscellaneous seeds, 54.4 per cent; browse, 6.6 per cent; grain, 0.6 per cent, and miscellaneous vegetable matter, 0.4 per cent.

GAMBEL QUAIL.

(*Lophortyx gambeli.*)

[PLATE II.]

The Gambel quail in general appearance is much like the valley quail, but, among other differences, lacks the scalelike feathers of the lower parts and has considerable chestnut along the flanks. It lives in the Lower Sonoran zone, from western Texas to southeastern California and from southern Utah and Nevada south through central Sonora, Mexico. The desert is its home, but it is rarely found far from water. Its favorite haunts are patches of bushy vegetation, such as mesquite, mimosa, creosote, and patches of prickly pear. It frequently takes up its abode about cultivated land, living in alfalfa fields or nesting in vineyards.

An interesting account of the habits of the Gambel quail in the Pahrump Valley, Nevada, is given by E. W. Nelson:

> I noticed that when a flock of quail came to feed on grain left by the horses an old male usually mounted the top of a tall bush close by and remained on guard for ten or fifteen minutes; then, if everything was quiet, he would fly down among his companions. At the first alarm the flock would take to the bushes, running swiftly, or flying when hard pressed. They roosted in the dense bunches of willows and cottonwoods growing along the ditches. * * * When feeding they have a series of low clucking and cooing notes which are kept up almost continually.[a]

The love note, according to Coues, may be represented in words as 'killink, killink.' Nesting takes place in April, sometimes not till May. About a dozen eggs usually constitute a clutch. In sections where this quail is still numerous the birds *pack* in bands of from 100 to 500 after the breeding season.

From the sportsman's point of view the Gambel quail as a game bird does not approach the bobwhite. It will sometimes lie to a dog

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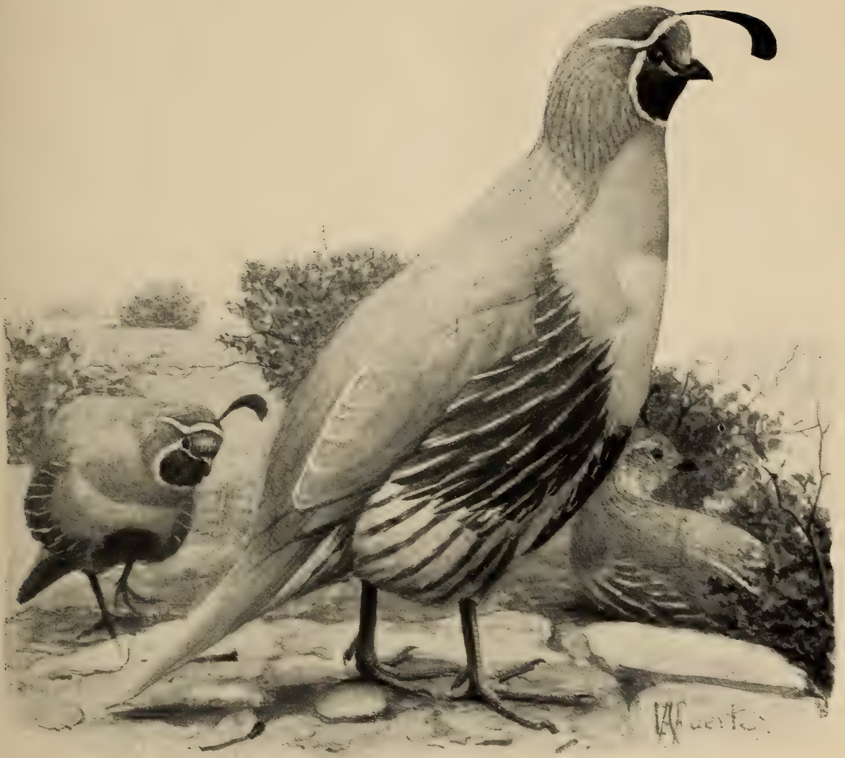
[a] N. A. Fauna, No. 7, pp. 29, 30, 1893.



GAMBEL QUAIL (LOPHORTYX GAMBELI).

fairly well, but as a rule it takes to its legs with all haste and leaves the dog on point, to the vexation of the hunter. It is, however, a useful species, which brightens the desert with its presence and contributes a welcome addition to the fare of the traveler. While less valuable than the bobwhite as a destroyer of noxious insects and as an object of sport, this bird well deserves protection for its food value and its beauty. It thrives under desert conditions and might be successfully introduced in the arid regions of Colorado, New Mexico, and Texas.

FOOD HABITS.

Stomachs of 28 birds collected mainly in Arizona and Utah, from January to June, have been examined. Only 0.48 per cent of the food consisted of insects; the remaining 99.52 per cent was vegetable matter. Like the valley quail, this is one of our least insectivorous birds. Its insect diet includes ants, beetles, grasshoppers, leaf hoppers (*Membracidæ*), and stink bugs (*Pentatomidæ*). Among the beetles are the western twelve-spotted cucumber beetle (*Diabrotica soror*) and *D. tenella*. The young chicks, however, will doubtless be found highly insectivorous and therefore useful.

The vegetable food of Gambel quail was made up as follows: Grain, 3.89 per cent, miscellaneous seeds, 31.89 per cent, and leaves and plant shoots, 63.74 per cent. From the present investigation the bird appears less frugivorous than any of the other American quails, for not one of the 28 stomachs contained fruit. Observers, however, say that the bird is somewhat frugivorous, and no doubt in a country well stocked with berries and fruit it would rapidly develop a frugivorous taste. Baird, Brewer, and Ridgway, for instance, state that during summer it makes its home in patches of *Solanum* and feeds on the tolerably palatable fruit, and also that it is known to eat gooseberries.[a] Coues says: "In the fall it gathers cherries and grapes. * * * It visits patches of prickly pear (*Opuntia*) to feed upon the soft juicy 'Tunas' that are eaten by everything in Arizona, from men and bears to beetles."[b]

The grain eaten by the Gambel quail was corn, wheat, and oats. In flocks numbering from 50 to 100, it feeds about grain stacks with domestic poultry. It is even more industrious as a browser on foliage than the valley quail. Succulent foliage and shoots form 63.74 per cent of its food. Much of this comes from alfalfa, bur clover, and the foliage of other legumes. Vernon Bailey, of the Biological Survey, says that at St. Thomas, Ariz., in January, 1889, this quail fairly swarmed on alfalfa fields, feeding on the green leaves and pods. He found flocks of from 25 to 50 in such situations, and during a five minutes' walk often saw a hundred birds. The same observer, when in Mohave County, Ariz., found that the bird fed principally on juicy plants when it could not procure water. At times it eats grass and its inflorescence, and it has been known to devour showy flowers. In spring it shows a fondness for buds. Baird, Brewer, and Ridgway note that then it feeds largely on the willow buds, which impart to its flesh a distinctly bitter taste.[a]

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[a] Birds of Northwest, p. 434, 1874.

[b] Hist. N. Am. Birds, III, p. 483, 1874.

The seed-eating habits of Gambel quail closely resemble those of the valley quail. Leguminous plants furnish the largest part of the seed food—21.17 per cent of the annual diet—alfalfa, bur clover, and kindred plants appearing to be preferred, but cassias, acacias, and lupines also are taken, as well as the beans of the mesquite, which in many places are a staple with birds and mammals. The seeds of alfilaria (*Erodium cicutarium*), another bird staple, furnish 2.28 per cent of the year's food. Miscellaneous seeds form 8.44 per cent. They are obtained from grasses, mallows (*Malva*), and such cruciferous plants as mustard (*Brassica*) and peppergrass (*Lepidium*); also from chickweed (*Cerastium*) and *Atriplex*.

MOUNTAIN QUAIL.

(*Oreortyx pictus*.[b])

The mountain quail occurs in the forested mountains of the humid Transition Zone of the Pacific coast, from Santa Barbara, Cal., to Washington, and in the mountains of the more arid Transition Zone on the west side of the Cascades in northern Oregeon and south over the Sierra Nevada to northern Lower California. The birds of the Sierra Nevada winter at lower altitudes than they nest, but those of the coast mountains do not make this vertical migration. This species is the largest and among the handsomest of American quail, with two long jet-black crest plumes and rich chestnut throat and flanks, the latter broadly banded transversely with spotless white.

The nests of the mountain quail are placed on the ground and usually contain 10 to 12 eggs, which vary from pale-cream color to a much darker due. At Tillamook, Oreg., June 30 and July 4, 1897, A. K. Fisher found newly hatched chicks; and at Donner, Cal., July 11 and 19, at an altitude ranging from 6,100 to 8,000 feet, Vernon Bailey found nine broods, varying in age from newly hatched chicks to half-grown birds. Bendire, quoting L. W. Green, of the United States Fish Commission, says that the earliest date of the nesting of the plumed mountain quail (*Oreortyx p. plumiferus*) known to him was April 15, and the latest, August 15. He states also that the cock bird takes care of the young.[a] Chester Barlow, in writing of the habits of the mountain quail, says that at Fyffe, Cal., it begins to nest the last of May or early in June. All nests that he found were built in a growth of 'mountain misery' (*Chamæbatia* sp.) 8 to 10 inches high.[b] On Mount Tallac and the higher slopes of Pyramid Peak, W. W. Price found newly hatched young as late as August 15. He noted that by September 1 the quail became restless and soon began their peculiar migration from the east slope to the west slope of the Sierras. From 4 to 6 adults with their young form a small band of from 10 to 30 individuals, and pursue their way almost wholly on foot to a more congenial winter climate; and by October 1 all had abandoned elevations above 5,000 feet. In spring they migrate back singly or in pairs.[c]

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[a] Hist. N. Am. Birds, III, p. 485, 1874.

[b] The name is used here to cover both the typical dark birds of the humid coast forests (*Oreortyx pictus*) and the paler one (*O. p. plumiferus*) of the more arid Transition Zone in the Sierras and Cascades.

There are many admirers of this bird because of its exquisite plumage, but most sportsmen prefer a game bird that lies better to the dog. Its flesh is excellent, and the bird sells well in the market. H. W. Henshaw reports that in the late fall of 1880 he found the markets of Portland, Oreg., well supplied with live mountain quails which had been trapped in the neighboring mountains, cooped, and sent to the city for sale. Nowhere is it so numerous as the California quail, or the bobwhite in the Southern States, and it is more of a forest-loving species than any other American quail. The mountain quail sometimes enters cleared fields, but so far as the records of the Biological Survey show it does no appreciable damage to cultivated fruits or other crops and it is a useful destroyer of weed seeds.

FOOD HABITS.

No stomachs of the mountain quail of the humid regions were available for examination, but Sandys writes that the bird feeds on insects and various seeds, including grain,[d] and Elliot says it sometimes approaches farm buildings in search of scattered kernels of grain.[e]

The food of the mountain quail of the arid regions has been studied in the laboratory of the Biological Survey. The stomachs examined, 23 in number, were collected in California. Five were collected in January, 2 in May, 6 in June, 3 in July, 3 in August, and

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[a] Life Hist. N. Am. Birds [I], p. 16, 1892.

[b] Condor, 3, p. 158, 1901.

[c] Condor, 3, pp. 158, 160, 1901.

[d] Upland Game Birds, p. 93, 1902.

[e] Gallinaceous Game Birds N. A., p. 42, 1897.

6 in November. The food consisted of animal matter, 3 per cent, and vegetable matter, 97 per cent. The animal food was made up of grasshoppers, 0.05 per cent; beetles, 0.23 per cent; miscellaneous insects, including ants and lepidopterous pupæ, 1.90 per cent; and centipedes and harvest spiders (*Phalangidæ*), 0.82 per cent. Among the beetles was a species of the firefly family (*Lampyridæ*), a ground beetle (*Carabidæ*), and a leaf beetle (*Haltica* sp.). Vernon Bailey informs the writer that the young eat many ants. The vegetable food consisted of grain, 18.20 per cent; seeds, practically all of weeds or other worthless plants, 46.61 per cent; fruit, 8.11 per cent; and miscellaneous vegetable matter, 24.08 per cent. The grain included wheat, corn, barley, and oats. Of the seed element the seeds of grasses formed 7.78 per cent; of legumes, 10.41 per cent; of weeds of the family *Euphorbiaceæ*, 3.16 per cent; of alfilaria (*Erodium cicutarium*), 2.76 per cent; and of miscellaneous weeds, 22.50 per cent. The legume seeds include seeds of alfalfa, cassia, bush clover, vetch, and lupine. The miscellaneous seeds come from wild carrot (*Daucus carota*), tar weed (*Madia sativa*), *Collomia* sp., *Amsinckia* sp., labiate plants, dwarf oak, snowbush (*Ceanothus cordulatus*), and thistle.

Concerning the feeding habits of mountain quail of the dry country (*O. p. plumiferus*), J. E. McClellan says: "Their feeding hours are early in the morning and just before sundown in the evening, when they go to roost in the thick tops of the scrub live oaks. Their feeding habits are similar to those of the domestic hen. They are vigorous scratchers, and will jump a foot or more from the ground to nip off leaves."[a] This bird is especially fond of the leaves of clover and other leguminous plants. It feeds also on flowers, being known to select those of Compositæ and blue-eyed grass (*Sisyrinchium*). Flowers, leaves, buds, and other kinds of vegetable matter form the 24.08 per cent marked miscellaneous. The birds probably eat more fruit than these stomach examinations indicate. Lyman Belding says that this quail feeds on service berries, and that during certain seasons it lives almost entirely on grass bulbs (*Melica bulbosa*), which it gets by scratching, for which its large, powerful feet are well adapted. The fruit in its bill of fare includes gooseberries, service berries (*Amelanchier alnifolia*), and grapes (*Vitis californica*). The bird is probably fond also of manzanita berries, for it is often seen among these shrubs.

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[a] MS. Records, Biological Survey.

SCALED QUAIL.

(*Callipepla squamata.*)[a]

The 'cotton top,' or scaled quail, as it is commonly known, is bluish gray on the back, with black-edged feathers on the under parts, which appear like large scales. Its conspicuous white-tipped crest has given it the local name of cotton top. It is found in southern Colorado and in the Upper and Lower Sonoran zones from Arizona to western and southern Texas and south to the Valley of Mexico. The birds of the lower Rio Grande region are darker than those farther west. According to Bendire, this quail lives on open arid plains overgrown with yucca, cactus, and sagebrush, and often gathers in coveys numbering 25 to 80. It lays about a dozen eggs, and he believes that two or three broods are reared in a season. The cock assists in the care of the young, but not in incubation.[b]

FOOD HABITS.

The food habits of this game bird are of especial interest. Stomachs and crops of 47 specimens have been examined, most of which came from New Mexico, the others from Arizona and Texas. They were collected as follows: January, 7; May, 1; June, 2; July, 3; September, 13; October, 19, and November, 2. As with all other gallinaceous birds, more or less mineral matter is swallowed, usually small pieces of quartz. The food consisted of animal matter, 29.6 per cent, and vegetable matter, 70.4 per cent.

The food of the cotton top differs from that of all other American quails in that it contains a large proportion of insects. These comprise no less than 29.03 per cent of its food, a percentage almost twice as great as that of the bobwhite, although if more stomachs of the present species had been available for examination the ratio might have been different. However, the important fact is established that this bird is a large consumer of insects, instead of being, like most other western quail, practically graminivorous. Of the insect food, grasshoppers comprise 15.86 per cent; beetles, 10.43 per cent, and miscellaneous insects, largely ants, 3.27 per cent. A few spiders also are taken, but they constitute only 0.03 per cent of the food for the year. The beetles are in the larval as well as the adult forms. The family of ground beetles (*Carabidæ*), a favorite one with terrestrial birds, is well represented. A single beetle with a featherlike antenna, of the family *Pyrochroidæ*, had been eaten. Some longicorn beetles and plant-eating scarabæid beetles also were eaten. A bird collected in

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[a] The name of the species is used here to include both the typical scaled quail (*Callipepla squamata*) and the more restricted chestnut-bellied quail of southern Texas (*C. s. castanogastris*).

[b] Life Hist. N. A. Birds [I], pp. 18–20, 1892.

June had consumed 44 of the latter beetles, which were leaf chafers, apparently closely related to the genus *Serica*. The scaled quail destroys also weevils, such as the clover weevil, *Sitones*, and certain species of the family *Otiorhynchidæ*, or scarred snout beetles. It takes also leaf beetles, the very injurious twelve-spotted cucumber beetle (*Diabrotica 12-punctata*). Further studies of the beetle food undoubtedly will disclose a large number of pests. The bird will probably be found to be a useful consumer also of grasshoppers, since a third of its September food consisted of them. Their remains were so fragmentary, however, that identification of species was unsatisfactory. In one case a member of the genus *Trimerotropis* was recognized. Ants had been eaten by 15 of the 47 birds examined. The other miscellaneous insects included small bugs (*Heteroptera*) and the chrysalis of a fly. One of the queerest objects found by the writer in birds' stomachs is the 'ground pearl' (*Margarodes*), several hundred of which were contained in the stomach of a cotton top shot at Roswell, N. Mex., June 17, 1899. They are lustrous and look like pearls, but are merely scale insects that feed on the roots of plants.

Vegetable matter furnished 70 per cent of the food of the scaled quail. Grain contributed 0.57 per cent; seeds, mostly weed seeds, 52.85 per cent; fruit, 12.65 per cent, and leaves and other green tissue, 4.33 per cent. The species resembles the ruffed grouse in its habit of feeding on green leaves and tender shoots. It feeds upon budded twigs, but more often limits its choice to chlorophyll-bearing tissue, often picking green seed pods of various plants. Like domestic fowls, it eats grass blades. Fruit was eaten by only 6 of the 47 birds, and none was taken from cultivated varieties. As might be expected from inhabitants of arid plains, these birds like the fruit of cacti, and have been found feeding on the prickly pear (*Opuntia lindheimeri*). The fruit of *Ibervillea lindheimeri* also is eaten. The blue berries of *Adelia angustifolia*, which furnish many desert birds and mammals with food, are often eaten by the scaled quail. Different kinds of *Rubus* fruits are relished, and the berries of *Koeberlinia spinosa* and *Momisia pallida* also are eaten. The fruit and succulent parts of plants no doubt serve in part in the parched desert as a substitute for water.

Seeds of various plants form a little more than half of the food. Legumes furnish 21.84 per cent, the mesquite (*Prosopis juliflora*), a staple with both man and beast, being utilized, as are the seeds of mimosa (*M. biuncifera*), besides various cassias and lupines. Seeds of vetch (*Vicia* sp.) are a favorite food, and *Morongia roemeriana* is eaten. The bird likes seeds of *Medicago*, and at times will eat clover seeds. Miscellaneous weed seeds yield 31.01 per cent of the annual food. Nearly half of these are seeds of bindweed (*Convolvulus* sp.), an abundant and troublesome weed in the South, where it often throttles other plants. The following miscellaneous seeds were found among their food:

Thistle (*Carduus* sp.).
Wild sunflower (*Helianthus annuus*).
Coreopsis (*Coreopsis coronaria*).
Aster (*Aster* sp.).
Chamomile (*Anthemis* sp.).
Pigweed (*Amaranthus* sp.).
Gromwell (*Lithospermum* sp.).
Borage (*Amsinckia* sp.).
Mallow (*Malva rotundifolia*).
Turkey mullein (*Croton setigerus*).
Croton (*Croton texensis*).
Alfilaria (*Erodium cicutarium*).
Spurge (*Euphorbia* sp.).

Grass seeds have not yet been found in quantity in the crop of the species, but panicum seeds have been recognized.

In summing up the economic status of the scaled quail it should be noted that although the bird is a desert species, it comes into more or less direct relation with agriculture, sometimes feeding upon cultivated land and about farm buildings. Moreover, half of its food consists of the seeds of weeds. Lastly, it is highly insectivorous, fully one-fourth of its food consisting of insects.

MEARNS QUAIL.

(*Cyrtonyx montezumæ mearnsi.*[a])

The pervading colors of the male Mearns quail are black, white, and chestnut. Its thick speckles of white and its peculiar shape suggest a miniature guinea hen. The species is found on the table-lands of Mexico from the City of Mexico north to western Texas, New Mexico, and Arizona, but the bird considered here is limited to the northern part of this range.

It is a confiding bird and either from excess of curiosity or from stupidity has been known to remain on the ground to be killed by a stick. From this lack of suspicion it has received the name 'fool quail.' It affords the sportsman with a dog much better shooting than its more erratic crested relatives. Grassy or bushy cover is more necessary to this bird than to the scaled quail or Gambel quail. Unlike the latter species, it does not pack, though it is more or less migratory. Its nesting habits are not well known. Bendire describes a nest found in Kinney County, Tex., June 22, 1890. It was placed in a depression of the ground, and contained 10 eggs.

FOOD HABITS.

The food habits of the Mearns quail are not well known. The Biological Survey has examined the contents of 9 crops and stomachs, secured in Texas and New Mexico during August and November. Two of the birds were killed in a patch of cactus. They contained seeds and spines from the prickly pear, acacia, and other seeds, grass blades, and a trace of insects—weevils and other beetles—besides a large quantity of coarse sand and iron ore. The other 7 birds were shot in August. Two had their crops filled with the bulbs of a lily. The others also had eaten lily bulbs, which in the 5 birds made three-fourths of the food. The other food was prickly pear fruit, seeds of legumes and spurges, and such insects as weevils, smooth caterpillars, hairy caterpillars, bugs, crickets, and grasshoppers. Cassin states that the contents of the crop of a specimen sent him from Texas by Captain French "consisted exclusively of fragments of insects, pronounced by Doctor Leconte to be principally grasshoppers and a specimen of *Spectrum*."[a] According to Baird, Brewer, and Ridgway, the Mearns quail appeared quite at home in cultivated fields and stubble of the ranches.[b] Away from civilization it prefers districts covered with open forest, with alternate areas of grass and scattered bushy undergrowth, or hillsides covered with grass and bushes. Its habits vary considerably with the locality. Bendire records that the species lives in rocky ravines and arroyos, but quickly adapts itself to ranch conditions and may be seen running about to gather kernels of scattered grain. He says also that it is fond of acorns, mountain laurel, arbutus, cedar, and other berries, and notes that its large, strong feet are well suited to unearthing the bulbs on which it feeds. He found holes 2 inches deep which it had dug for this purpose. These quail often come out into mountain roads to search for scattered grain and to dust themselves. As they are readily tamed, they could doubtless be successfully introduced into other regions.

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[a] The typical Massena quail (*Cyrtonyx montezumæ*) is a bird of the mountains about the Mexican table-land, and gives way to the paler Mearns quail (*C. m. mearnsi*) in northern Mexico and the southwestern United States.

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[a] Illustration of Birds of California, Texas, etc., p. 25, 1856.

[b] Hist. N. Am. Birds, III, p. 492, 1874.

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U. S. DEPARTMENT OF AGRICULTURE
BIOLOGICAL SURVEY—BULLETIN No. 22
C. HART MERRIAM, *Chief*

BIRDS KNOWN TO EAT THE BOLL WEEVIL

BY

VERNON BAILEY
CHIEF FIELD NATURALIST, BIOLOGICAL SURVEY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1905

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., July 25, 1905.

Sir: I have the honor to transmit herewith for publication as Bulletin No. 22 of the Biological Survey a preliminary report upon birds in their relation to the boll weevil, by Vernon Bailey. In view of the fact that this destructive insect continues to extend its range into unoccupied cotton regions, it is obvious that no factor in the warfare against it can safely be neglected. The relation of birds to the boll weevil and the extent of dependence that can be placed upon the former in limiting its inroads are not well understood. As requests from the cotton districts for information upon the subject have been many and urgent, field investigations, of which the present bulletin is the first outcome, are now being conducted by the Biological Survey, with a view to ascertaining the particular birds which perform the most important service in preying upon the weevil, to the end that special protection be extended to such species.

Respectfully,

A. K. Fisher,
Acting Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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BIRDS KNOWN TO EAT THE BOLL WEEVIL.

INTRODUCTION.

For several years past the cotton growers of Texas, as is well known, have sustained enormous losses through the ravages of cotton boll weevils. Remedial measures of various kinds have been tried, but, though some of these undoubtedly have proved more or less effective, the number of insects does not seem to have been materially reduced, and their progress into other cotton-producing districts has been steady, the borders of their range widening yearly.

The extent to which the native birds feed upon this, one of the most destructive insect pests that have ever appeared in the United States, is yet but imperfectly understood, and investigations are now being conducted by the Biological Survey with a view to determining just what species feed upon the weevil and the extent to which it enters into the fare of each.

The fact that for the past twelve years the weevil has been steadily spreading over the cotton-producing area forbids the assumption that birds are likely ever to exterminate the insects. Nevertheless, as will appear from facts presented below, certain species prey upon the weevil to a greater or less extent, and it is probable that by carefully protecting such species and by encouraging their increase the good work they now do may be greatly augmented in the future. Thus, the question of extermination aside, birds are likely to prove an effective ally in checking the increase of the pest. The fact that other species of weevils are a favorite diet with many of our insectivorous birds has been proved by previous investigations.[a] Moreover, it is well known that when a new insect first appears in a district birds are somewhat slow in acquiring a taste for it and in sufficiently learning its haunts and hiding places to effectively pursue and capture it. It is probable, therefore, that some birds which at present are not known to attack the weevil at all will later acquire a taste for it, and that others which now feed upon it sparingly will in future feed upon it to a greater extent.

The present report is in response to urgent appeals from the infested and threatened cotton districts for reliable information as to the species of birds which feed upon the boll weevil. Field work for the purpose of obtaining this information was begun at Seguin, Guadalupe County, in southern Texas, October 31, 1904, and was carried on at several localities in the boll weevil district until December 16. Investigations now in progress in the field and laboratory will cover the remainder of the year, including the season of greatest abundance and activity of the weevils, and will furnish material for more general and definite conclusions.

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[a] Food of Bobolink, Blackbirds, and Grackles, by F. E. L. Beal, Biological Survey Bulletin No. 13, pp. 22, 44, 52, 69, and 189.

In the course of their investigations of the boll weevil the Entomologists of the Department examined the stomachs of a large number of birds collected in and around the cotton fields, and the results appear in Bulletin 51 of the Bureau of Entomology, on the Mexican Cotton Boll Weevil. These results have been tabulated and appear in the summary of the present report.

FIELD NOTES.

The following field notes relate only to the birds found to have eaten boll weevils.

Carolina wren (*Thryothorus ludovicianus*).—Carolina wrens were common at Columbus, Eagle Lake, and Wharton, were fairly abundant at Navasota, and a few were seen at Seguin. They were rarely found in the fields, but were constantly dodging in and out of the brush heaps, log piles, and vine tangles, running over the rough bark of old trunks and roots and logs, peeking and peering and picking in all of the dark corners overlooked by larger species, and even hunting among the dry leaves on the ground under logs and brush. They were generally in pairs, and sometimes two pairs were found in one brush heap, while almost every thicket or vine tangle contained one or several of the birds. Those observed were apparently permanent residents. Seven were shot, 5 of which had eaten boll weevils for breakfast, and one of these had eaten 2, making 6 weevils to 7 birds at one meal. As all but one of the birds were taken after the frosts, there is no reason to doubt that the good work of this species goes on throughout the winter.

Titlark, Pipit (*Anthus pensilvanicus*).—Titlarks were first seen at Columbus, November 14, and this evidently was about their first appearance. Large flocks were seen in the cotton fields the next day, and at Eagle Lake and Wharton a few days later. At Navasota they were still numerous in flocks of 100 or more at the time of my departure, December 16. At Wharton and Eagle Lake, where most of the birds were collected, flocks of 100 to 500 were constantly in the cotton fields, seeking food as they ran or walked over the ground. When flushed they flew to another part of the field or to a neighboring field, disappearing among the cotton stalks. The eight individuals shot contained remains of five boll weevils. Allowing the birds only two meals a day, at this rate they would consume 125 per cent of their own numbers in boll weevils daily. Considering the abundance of these birds, none of the other species collected equal them as weevil destroyers, at least at this particular season.

It is perhaps of interest to add that the titlarks breed in great numbers above timber line in the high mountains of New Mexico, Colorado, and northward, and winter in still greater numbers in southern Texas.

Black-crested titmouse, Tomtit (*Bœolophus atricristatus*).—Tomtits were fairly common at Seguin and Navasota, in their usual resident numbers. They hunt mainly over the branches and trunks of the trees, where they pry into all the cracks and crevices of bark and broken wood. Only 2 were shot, 1 of which had eaten a boll weevil.

Western meadow lark (*Sturnella magna neglecta*).—The western meadow larks were seen from the train between Austin and San Antonio, October 28, rising in flocks of 10 to 100 from almost every cotton field along the railroad. In one field of not more than 20 acres 108 birds were counted. At Seguin they were abundant from October 31 to November 12, and at Eagle Lake they were common to November 19 over the open country, or, sometimes, in company with the more common Florida form, *argutula*, in the fields. At Navasota they were still abundant on the open prairie and in fields up to December 16, but less common in the fields and wooded country than *argutula*. These dates merely indicate that the meadow larks had arrived in full force from the north before my arrival in the field and remained in undiminished numbers to the time of my departure after the middle of December. The greater number of those sent in for examination were shot from November 1 to 12 at Seguin, where only *neglecta* was found. Here it was one of the most abundant birds in the fields. In walking across a 40-acre cotton field I usually flushed 200 or 300 western meadow larks. In corn and sorghum fields the birds were just as common, but as fully three-fourths of the fields in this region are devoted to cotton the greater numbers of birds were found in the cotton fields. The open nature of these fields, with the partial concealment and protection offered by the rows of cotton stalks, makes them favorite feeding ground for the larks.

The 18 boll weevils eaten by the 64 birds probably represent a fair average of the number of weevils eaten at one meal at this season. Allowing the birds at least two meals a day, the birds safely may be assumed to destroy over 50 percent of their own number in weevils daily. This good work carried on throughout the fall and winter months can not fail to have an important effect on the next year's crop of weevils.

Florida meadow lark (*Sturnella magna argutula*).—The Florida meadow larks were first found at Eagle Lake, November 18, where they were more numerous than *neglecta*, with which they were associated in the cotton fields. At Wharton they were common and the only form found. By the nature of the country they were restricted to the large cotton and cane fields which occupy the only clearings in the heavy forest; and until the sugar cane is cut, usually late in November, the larks were practically restricted to the cotton fields. At Navasota they were common up to my departure, December 16, and their favorite resorts were the cotton and corn fields of the timbered river bottoms. Here the western meadow lark was associated with them to some extent, but seemed to prefer the open prairie strips of this half-forested region. In abundance and habits the Florida form does not differ greatly from the western meadow lark, and the conclusions in regard to one would apply in a general way to both. The slightly smaller proportion of boll weevils eaten by *argutula* is probably due to the fact that the specimens were collected later in the season.

Common phœbe (*Sayornis phœbe*).—The common phœbe was the only member of the flycatcher group seen, and it was common at every locality visited from November 1 to December 16. It is a winter resident only in this part of Texas, arriving usually in October and remaining till April. As it did not diminish in numbers up to the middle of December, it evidently remains in full force throughout the winter. It frequents brushy and open country and is often found during feeding hours sitting on top of a cotton plant or cornstalk out in a field. In walking across a cotton field half a dozen birds were sometimes seen. Most of their food was taken on the wing, but they often dived to the ground in pursuit of insects. The fact that 2 out of 10 birds had eaten boll weevils suggests that the several other species of flycatchers which spend the summer in the boll-weevil region may do important service in snapping up weevils on the wing during the period of greatest activity of the insect.

Redwing blackbird (*Agelaius phœniceus*).—A few redwing blackbirds were found at Seguin November 7; two days later several small flocks were seen; and by the 12th they were fairly common in flocks of 20 to 50. At Columbus a few were shot from a flock of 100 or more in a cotton field November 15, and other large flocks were seen. At Eagle Lake, on the edge of the prairie, November 16 to 19, the redwings in flocks were innumerable, and I could only estimate them at hundreds of thousands of individuals. Numbers of cowbirds were in these flocks, but most of them were redwings. At a distance the flocks looked like clouds of smoke, but nearer, as they rose and wheeled and circled over the fields, they suggested rapidly moving clouds or dust in the desert. As they settled down, they blackened the stacks of rice straw, fences, and trees, or disappeared in the rice stubble or fields of weeds. Those in the cotton fields were lighting on the trees and tall weeds along the fence rows and making side trips in squads of 1,000 or so to different parts of the fields. As these flocks settled among the cotton stalks, it was probably mainly for grass and weed seeds, which with broken rice comprised the contents of most of the crops and gizzards, but the fact that 2 out of the 27 individuals shot had eaten boll weevils is of some significance in consideration of the vast numbers of the birds.

Western savanna sparrow (*Passerculus sandwichensis alaudinus*).—Western savanna sparrows were abundant at all of the localities visited during the time of my stay in Texas. They are so small and inconspicuous as to escape general notice, but as I walked through the cotton fields they were constantly darting out from before me, running to right and left to avoid flight, or flying a short distance and dropping again into the grass. Out of 18 shot only 1 was found to have eaten a boll weevil, so the importance of the species is not great, even considering the abundance of the individuals.

White-throated sparrow (*Zonotrichia albicollis*).—White-throated sparrows were first seen at Eagle Lake November 16, where they took the place of the white-crowned sparrow found at Seguin. They were common at Wharton and extremely numerous at Navasota up to the close of my work. Their favorite feeding grounds were in the thickets and brushy borders of fields, where they were constantly rustling among the weeds and leaves in search of food. Of the 9 specimens collected only 1 had eaten a boll weevil.

Brown thrasher (*Toxostoma rufum*).—One brown thrasher was seen at Columbus November 15 and one at Wharton November 17. A few were seen at Liberty November 21, and they were common throughout the Big Thicket country near Saratoga and at Navasota up to December 16. At Navasota, where all of the specimens were procured, December 10 to 15, they were fairly abundant in the thickets and brush rows around the edges of fields. Individuals were easily located at some distance by the noise they made scratching and running among the dry leaves, and a good many were shot in the hope that they were unearthing and eating boll weevils. Of the 28 specimens, however, but 1 had eaten a boll weevil.

Texas bobwhite (*Colinus virginianus texanus*).—Thirty-five specimens of Texas bobwhite were collected at Seguin between November 2 and 12, where at the opening of the hunting season they were abundant. Later a few flocks were seen at or near Columbus, Eagle Lake, Wharton, and Navasota, but at all of these places they were comparatively scarce and the flocks were scattered and wild. At Seguin almost every field and pasture contained one to three coveys of 10 to 20 quail, which were generally to be found not far from their chosen roosting thickets or feeding grounds. On many of the farms one or more flocks had taken up quarters close to the houses or in the orchard or garden and had become comparatively tame. At Mr. Neel's place, where most of my work was done, a flock of about a dozen birds lived in the orchard, garden, and barnyard, and when frightened rarely flew beyond these limits. The farthest from the house that I ever found them was in the edge of the adjoining cotton field, where toward sundown they were often seen feeding. Mr. Neel called my attention to the fact that about one-third more cotton had been gathered from the part of the field near the house, where his 100 chickens and these quail habitually fed during the summer, than over the rest of the field. At the farther end of this field another flock of 8 or 10 quail lived in the mesquite brush and made daily rounds out into the field to feed. The birds were shot in other fields farther from the house, and in all cases either out in the fields, where they were usually found feeding during the morning and evening hours, or in the brush along the edges of the fields, where they roosted at night and were generally found during the middle of the day.

The fact that at this time the quail were feeding almost exclusively on weed seeds was evidently due to the great abundance of freshly ripened seeds. During the summer months the quail, especially the young, are known to feed to a much greater extent on insect food, and it is reasonable to expect that later in the season, especially during the winter and spring months, after the weevils have left the cotton, the quail scratch them up from under leaves and rubbish.

CONDITION OF COTTON FIELDS DURING INVESTIGATIONS.

At the beginning of the field work at Seguin, October 31, 1904, cotton picking was just completed; but owing to recent rains a second crop of leaves, buds, and young bolls had started on the tops of the cotton plants, and the weevils were actively engaged in feeding on the buds or young bolls within the cover of the closed squares. The weevils apparently were less abundant than during the summer months, and as their breeding season seemed to have closed they were probably also less active. Otherwise, the conditions so far as related to the weevils were essentially the same as in summer. These conditions were unchanged up to November 12, when the first hard frost of the season occurred over most of southern Texas, including Seguin, where investigations were in progress at the time. Most of the cotton was killed, and by the third day the weevils had left the dead and dried-up cotton tops and disappeared. Still, a few fields or parts of fields escaped the frost, and from November 13 to 20, in the vicinity of Columbus, Eagle Lake, and Wharton, a large number of birds were shot in and around these fields to determine whether they were eating more than the usual number of weevils, as the insects were driven from the cover of the protecting bracts and forced to seek winter quarters.

Still later, at Navasota, December 10 to 16, long after all the cotton had been killed and dried up and the weevils forced to seek winter quarters, 100 birds were collected, mainly in woods, brush, and weed patches surrounding the cotton fields. As no boll weevils could be found in the cotton fields at this time it is fair to assume that they had gone into winter quarters. Such, briefly, was the status of the cotton fields in relation to the weevils during the investigations.

CONDITIONS OF BIRD LIFE DURING INVESTIGATIONS.

At the several localities the species of birds inhabiting the cotton fields varied from time to time. At Seguin western species predominated, while at Wharton and Navasota mainly eastern birds were found. During the time covered by the investigations the resident summer birds were leaving and the winter species were arriving. Many of the insectivorous summer residents, such as orioles, flycatchers, swallows, martins, night-hawks, and whip-poor-wills, had disappeared when the work began, and their places were filled by numerous seed-eating migrants of the sparrow family. Moreover, the well-known change of food habits of resident species, like the quail, which are largely insectivorous during the summer and mainly seed-eating during the fall and winter, when the present investigations were chiefly made, must be taken into account in estimating their value as destroyers of weevils.

DECREASE IN NUMBER OF WEEVILS.

Of the 354 birds killed, approximately 10 per cent had eaten boll weevils. Examination of the stomachs collected at different dates shows a slight decrease in the number of weevils eaten as the season advanced. In round numbers, those eaten during the period of green cotton, October 31 to November 12, were 11 per cent of the number of birds killed; for the period of change from green to dry after the first hard frost, November 13 to 20, 10 per cent of the number of birds; for the period of dry cotton after the disappearance of the weevils, December 10 to 16, 8 per cent. The fact, as stated above, that fewer weevils appear in the stomachs of birds shot during the later period than in the earlier one, is evidently due to the diminished supply of weevils.

Out of the 38 species of birds collected which had not eaten boll weevils, 17 species were represented by only 1 specimen each, hence the negative evidence in regard to these is of little significance. If greater numbers of the same species had been collected or if they had been collected at another season they might appear among the number of enemies of the weevil.

EXAMINATION OF BIRD STOMACHS.

It being found impracticable in the field to determine with any degree of certainty whether or not the birds had eaten boll weevils, all stomachs were preserved and sent to Washington, where they were examined and the boll weevils identified by Prof. F. E. L. Beal, of the Biological Survey.

INVESTIGATIONS BY BUREAU OF ENTOMOLOGY.

In Bulletin No. 51, published by the Bureau of Entomology, on the Mexican Cotton Boll Weevil, are given the results of the examination by Mr. E. A. Schwarz of the stomachs of 17 species of birds. These birds are added to the list presented below, and indicated by stars, and the data are utilized in the general conclusions. Except those of the mourning doves and quail, the stomachs were taken from birds collected at Victoria, Tex., and of these "100 were obtained during the last week of February, 7 during June, 3 during July, 26 during August, and 380 between September and December."[a]

Out of the 17 species of birds, 11 species had eaten boll weevils, as appears in the following table. These 11 species comprised 237 individuals, of which 44 individuals had eaten boll weevils. The 6 species of birds that had not eaten weevils were mourning dove, quail, redwing blackbird, lark sparrow, grassfinch, and blue-gray gnatcatcher.

Eliminating the mourning doves, which practically never eat insects, and the quail, which eat very few at the season when these were collected (November), there remains a total of 255 bird stomachs examined, of which 44 contained boll weevils.

CONCLUSIONS AND RECOMMENDATIONS.

The total number of stomachs examined in the Biological Survey and Bureau of Entomology, aside from mourning doves and quail, was 570. Of these, 78, or 13.6 per cent, contained boll weevils. The total number of weevils eaten by 78 birds was 101, or 17.7 per cent of the total number of stomachs.

With reference to the comparatively small number of cotton boll weevils eaten by any of the birds examined it should be borne in mind that during the time when most of the birds were collected adult weevils were not numerous. During the earlier period of the field work (October 31 to November 12) the insects were practically all within the squares on the green cotton plants, and it was a simple matter to examine the squares and locate all the weevils along a cotton row. This was done again and again in order that their numbers could be estimated, and in no case did they average more than one to a hill of cotton, and rarely more than one to three hills. Thus as the number of weevils consumed in a field equals 17.7 per cent of the number of birds occupying that field per day, or, by allowing the birds two meals a day, 35.5 per cent of their number, the destruction of weevils is after all comparatively rapid; but as this ratio depends largely on the abundance of the weevils—the more numerous the weevils naturally the greater the number eaten—their complete extermination by birds is hardly to be expected. It is impossible to learn just how many times a day a bird's stomach is filled and emptied, but it is well known that birds with crops fill both crop and stomach twice a day. Most insectivorous birds are without crops, however, and as they usually feed more or less continuously from early morning to evening it is not improbable that the stomach is filled and emptied five or six times daily. As examinations of bird stomachs are based upon only a small portion of the day's food, the number of weevils detected is probably far less than are actually destroyed daily. Even the incomplete data thus far obtained, however, suggest that without the aid of the birds no cotton can be raised in the weevil-infested area.

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[a] The Mexican Cotton Boll Weevil, by W. D. Hunter and W. E. Hinds, Bulletin No. 51, Bureau of Entomology, Department of Agriculture, 1905, p. 151.

Until two years ago the protection afforded birds by law in the State of Texas was very inadequate, and many of the most important insectivorous species were slaughtered for sport or for their plumage. Thus their numbers were greatly reduced and some kinds were nearly exterminated. In 1903 a State law was passed providing for the protection of all nongame birds and fixing a close season for turkeys, grouse, quail, and doves, but giving no protection to killdeer, plover, snipe, and many other insectivorous shore birds which are now legitimate game at all seasons. The law in respect to the shore birds should be changed, since it is known that at least one species of plover, the killdeer, feeds upon cotton boll weevils to a greater or less extent, one of the two specimens examined having eaten three adult insects. The fact that the killdeer remains in and about the cotton fields the year through emphasizes the importance not only of extending protection to this particular bird at all seasons, but of protecting as well the other plovers and shore birds which have similar insectivorous habits. The desirability of such protection is emphasized by the fact that formerly the upland plover, one of the most insectivorous of all species, abounded on the Texas prairies. It was, however, slaughtered by the wagon load for market, and now where it once swarmed it is comparatively rare. It is highly probable that this species would lend efficient aid in the warfare against the weevil were it permitted to winter unmolested within the borders of the State. Moreover, the present law protecting the nongame birds, such as meadow larks, grackles, orioles, and flycatchers, is to no small extent disregarded, and many of the most beneficial birds are being destroyed. An efficient warden service would no doubt aid in preserving the birds, but the bird laws of a State can be made really effective only when supported by public sentiment, prompted by a widespread knowledge and appreciation of the services birds render to man. When the value of these services in the present war against the boll weevil is understood throughout the cotton States it must result in an enlightened public sentiment in favor of the birds.

The necessity of extending every possible protection and encouragement to insectivorous birds within the cotton-producing districts of Texas and other Southern States is strongly urged.

LIST OF BIRDS WHICH HAD EATEN BOLL WEEVILS.

Species.	Number of birds examined.	Number that had eaten boll weevils.	Number of boll weevils eaten.	Species.	Number of birds examined.	Number that had eaten boll weevils.	Number of boll weevils eaten.
Carolina wren	7	5	6	*Brewer blackbird	10	5	11
Titlark, Pipit	8	4	5	*Cowbird	31	4	4
Tomtit, Black-crested titmouse	2	1	1	*Jackdaw, Great-tailed grackle	10	2	2
Western meadow lark	64	12	18	*Western meadow lark	153	23	26
Florida meadow lark	30	5	6	*Mockingbird	17	3	3
Common phœbe	10	2	2	*Butcherbird	7	2	5
Redwing blackbird	27	2	2	*Killdeer	2	1	3
				*Baltimore oriole	3	1	1
White-throated sparrow	9	1	1	*Dickcissel	1	1	1
				*Scissor-tail flycatcher	1	1	1
Western savanna sparrow	18	1	1	*Common phœbe	2	1	1
Brown thrasher	28	1	1	Total	475	79	102
Texas bobwhite	35	1	1				

* Examined by Mr. E. A. Schwarz. See Bulletin 51, Bureau of Entomology, 1905.

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U. S. DEPARTMENT OF AGRICULTURE

BIOLOGICAL SURVEY—BULLETIN No. 23

C. HART MERRIAM, Chief

THE HORNED LARKS AND THEIR RELATION TO AGRICULTURE

BY

W. L. McATEE

Assistant, Biological Survey

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WASHINGTON
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1905

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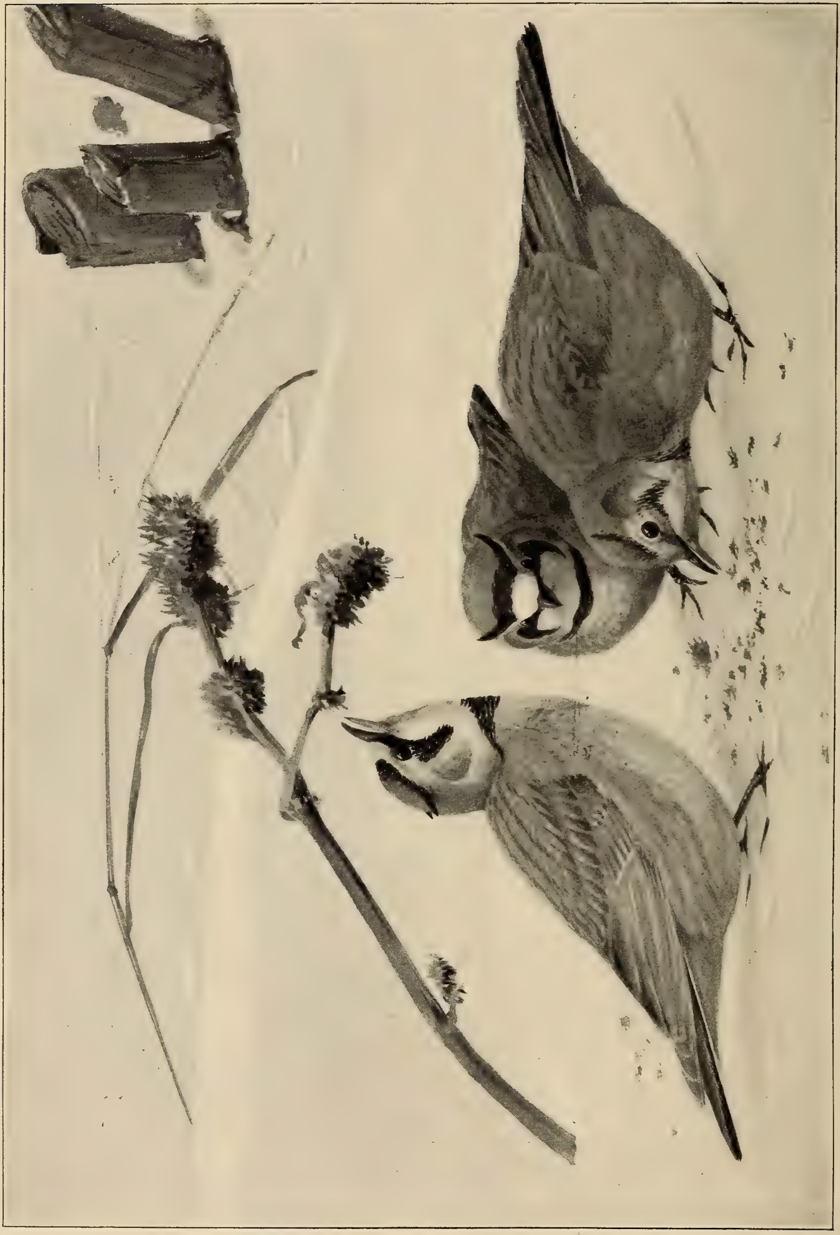

Horned Larks Feeding on Amaranth.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., September 1, 1905.

Sir: I have the honor to transmit herewith for publication as Bulletin No. 23 of the Biological Survey a report on the Horned Larks and their Relation to Agriculture, by W. L. McAtee, an assistant in the Biological Survey. The horned larks, though of small size, form an important group economically because of their very general distribution, their great numbers, and their food habits. As a result of the present investigation it appears that though these birds feed to some extent upon grain, the actual damage done is slight, because the grain eaten is mostly waste. On the other hand, the birds are shown to feed very largely upon insects and weed seeds, among which are some of the worst pests that the farmer has to contend with. The horned larks, therefore, should be classed among the species highly beneficial to agriculture.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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THE HORNED LARKS AND THEIR RELATION TO AGRICULTURE.

DISTRIBUTION AND HABITS.

The horned larks are small but hardy birds which frequent the open country and never live in forests. They are found in a great variety of situations, and feed along roads, in weedy or freshly plowed fields, on commons or other waste places, and in closely grazed pastures, meadows, and stubble fields. The beaches and salt marshes of the coasts, the lake shores, muddy flats, and swamps of the interior are thronged with them in fall and winter. In the far West they live in hot desert valleys, on arid table-lands, on level grassy prairies, in the foothills, and even on bare mountain peaks.

They are readily distinguished from other small ground-loving birds. They are about the size of the bluebird, their throats are white or yellow, there is a conspicuous black mark across the breast, and just above and behind the eyes are small pointed tufts of dark-colored feathers which are often erected. These black tufts or horns are perhaps the bird's most characteristic feature, and give origin to the common name 'horned lark,' by which it is known over most of the United States. 'Shore lark' is another common name, though a less apt one. The various subspecies are distinguished by names which convey an idea of the surroundings of the bird or of its appearance—prairie, desert, scorched, and pallid horned lark being examples of these designations. West of the Mississippi several names indicative of the bird's habits are used, among them being 'prairie bird', 'road trotter,' and 'wheat bird.' In parts of Canada it is known as 'spring' or 'life bird,' in allusion, no doubt, to its reappearance in the vernal season.

Many of the popular names of the horned larks emphasize the fact that they are preeminently terrestrial birds. During the day they run nimbly over the surface in quest of food; at night they roost in small companies on the bare earth. A clod or stone is a favorite perch, and they are rarely seen in a bush or tree.

They nest early, the first clutch of eggs often being completed before the snow has disappeared. The nests are of the simplest description, in keeping with the artless character of the bird, being little cups of grass placed in slight depressions in the ground. Two or even three broods are raised in a year, a fact which sufficiently explains the great numbers of the species in some localities.

The flight of the horned larks is hesitant. They usually start hurriedly from the ground, uttering short, whistled notes, and it is very characteristic of them that frequently when disturbed they fly straight away for a short distance, only to swing around and alight near the starting point. In the mating season, however, they ascend to great heights and, like the skylark, sing while on the wing. The song is neither complex nor loud, but it is wild, joyous, and full of the free spirit of the prairie and the open fields.

The birds thus characterized occur at some time of the year in all parts of North America, except the Aleutian Islands, the southern coastal portion of Alaska, extreme southeastern United States, and Central America. This vast range is occupied by only one species, which, however, varies so greatly in different localities that it has been separated into no fewer than twenty-one varieties or subspecies.[a]

During the breeding season these geographic forms are restricted to separate areas, but in winter, on account of the tendency of the southern races to wander and of the northern ones to migrate, the subspecies mingle, and as many as seven (Arizona) or eight (California) forms occur in one State. In summer in the United States (including Alaska) there are fifteen subspecies of horned larks, and in winter seventeen.

The several members of the family *Alaudidæ*, which includes these forms, are interesting birds. Their habit of walking, instead of hopping, distinguishes them from many small ground birds. They have long hind claws, the prints of which in the snow or along the muddy shores of ponds often indicate where the larks have been running. They molt but once a year, usually in August, while many birds molt twice and a few three times. The nuptial dress is acquired not by molting, but by the wearing away of the tips of the winter feathers, revealing the brighter colors beneath. The plumage of the larks is generally neutral in tint, especially when viewed from above, and so harmonizes with their surroundings that it has a protective value, and enables the birds, in a measure, to escape the notice of enemies.

GENERAL FOOD HABITS AND ECONOMIC RELATIONS.

A preliminary report upon the food of the horned larks, by Prof. Walter B. Barrows, formerly of the Biological Survey, was published in the Report of the Secretary of Agriculture for 1892. It was based upon the examination of 59 stomachs. A much larger amount of material is available for the present paper, no fewer than 1,154 stomachs having been examined. The present material represents also a much greater area, coming from no fewer than twenty-five States and Territories, and in addition the District of Columbia, Ontario, Saskatchewan, and Mackenzie. Among the specimens collected are nestling, adolescent, and adult birds, including representatives of eleven subspecies.

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[a] For descriptions and ranges of the subspecific forms the reader is referred to H. C Oberholser's 'Review of the Larks of the Genus Otocoris;' Proceedings of the U. S.. Nat. Museum, Vol. XXIV, pp. 801–880, 1902.

The food habits of the several forms are very similar with the exception of the central and southern California bird (*Otocoris alpestris actia* Oberh.), which is so anomalous in its feeding habits that it has been deemed advisable to treat it also separately.

Professor Barrows found that the horned larks examined by him had consumed during the year 11.42 percent of animal matter and 88.58 percent of vegetable matter. The present investigation results in a somewhat different showing for the birds, there being in the food more insects and less vegetable elements, or 20.6 percent of animal and 79.4 percent of vegetable matter.

From the accompanying chart (fig. 1) the proportions of the components of the food for each month may be seen at a glance. Very little animal matter is obtained during the winter months. The few insects alive at this season are usually well concealed and the wonder is that the birds obtain any of them. In January, animal matter, consisting principally of weevils and cocoons of tineid moths, composes only 1.73 percent of the food. In February about the same things are eaten, but in larger amount, making 3.11 percent. The percentage rises rapidly in March and April, principally because of an increase in the number of weevils, caterpillars, and bugs eaten, although beetle larvæ and leaf beetles also are consumed in larger amount. In these months the horned larks obtain respectively 15.72 percent and 27.31 percent of animal matter. April is the first month when the amount of animal matter eaten is in excess of the

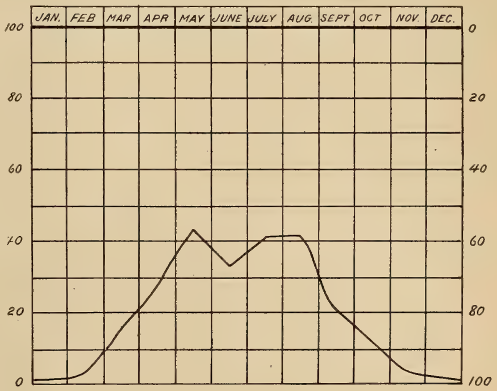

Fig. 1.—Diagram showing the proportions of animal and vegetable food of the horned larks of the United States, exclusive of the members of the subspecies *Otocoris a. actia*, for every month in the year. [Read the column of figures on the left from the bottom upward for the percentage of animal food, and the column on the right from the top downward for the percentage of vegetable food. The area below the curve represents the total amount of animal food for the year, and that above, the vegetable food.]

monthly average, and it is consumed by the adults alone. This result is in harmony with the observed fact that the breeding season taxes the strength of birds, and hence an easily assimilated, highly nutritious food is required.

In May there is a further increase in the amount of animal food eaten, the maximum (43.4 percent) for the year being reached. The percentage is higher in this month because there are included in the computations several nestlings, which were fed almost exclusively upon insects. However, the adults also consume more animal food at this time, and the adolescent birds, while they do not eat as large an amount as their parents, have not developed the strong vegetarian taste which characterizes them later. The principal elements of the animal food in May are weevils, May beetles (insects more commonly known as June bugs), caterpillars, and grasshoppers. In June the amount of insects eaten becomes smaller. The former nestlings, now independent of the old birds, are largely vegetarian, and counteract the influence of the adults, which are even more insectivorous in this month than in May. More weevils, leaf beetles, and ants are eaten in June than in May, but fewer May beetles, caterpillars, and grasshoppers.

From May to August the proportion of animal food would probably be about the same in each month were it not for the peculiar diet of the young birds. The consumption of the maximum number of insects in May is the result of the influence of the nestlings and adolescent larks. The former, being highly insectivorous, raise the percentage in May, while the adolescent birds, because of the opposite trait, tend to lower the percentage in June, July, and August. When the diet of the adults alone is considered, the proportion of animal food for the latter part of the summer increases, and the maximum comes, as in the case of a great many other species, in August. (See fig. 2.) Two factors tend to raise the percentage of animal food in this month—first, the molt, which in many cases is known to create a ravenous appetite for such food, and, second, the great abundance of insects, particularly grasshoppers, these in August forming the bulk of the animal food of many species of birds. Although horned larks eat a considerable number of grasshoppers, they consume a greater number of weevils than of any other insects. These small, inconspicuously colored insects, most of which are actual or incipient pests of the worst kind, constitute nearly 18 percent of the food in August. After this month the amount of animal food decreases rapidly. Caterpillars, grasshoppers, beetle larvæ, scarabæid and carabid beetles are soon entirely lacking. The lowest point in the entire year for the consumption of animal food is reached in December, when only 1 percent is obtained. During the winter months, when little animal matter is eaten and the amount of vegetable food is at its maximum, considerable grain is consumed, but about three-fourths of the food are weed seed.

Few examinations of the stomachs of horned larks have been made except in the Biological Survey, most ornithologists contenting themselves with casual field observations on the food habits. Examination of all accessible accounts reveals but few items of food not met with in the course of the present investigation, these being such unimportant substances as minute crustaceans, cactus seeds, and plant buds, none of which are commonly eaten.

The food habits of the horned lark—*Otocoris alpestris flava* (Gmelin)—of Europe, judging from published accounts, are essentially like those of our own forms, to which it is closely related. In Germany another species, the skylark, in recognition of its value as an insect destroyer, is protected by law from May to September 15;[a] but at other seasons it is taken in nets in large numbers for food.

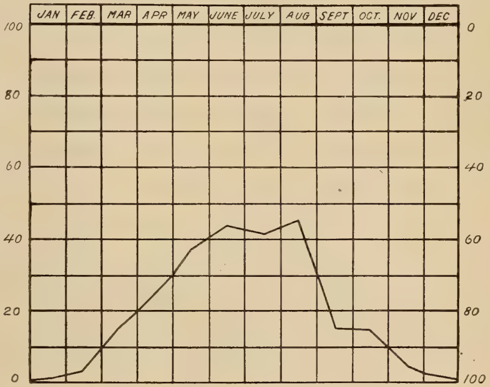

FIG. 2.—Diagram showing the proportions of animal and vegetable food of the adult horned larks for every month in the year.

In former times larks were much used for food also in the United States. They occur in flocks in winter, are easily trapped, and years ago the markets of many of our large cities were abundantly supplied with them. This traffic has not entirely ceased at the present time. In 1891[b] W. E. Bryant wrote concerning the marketing of horned larks:

> For an indefinite number of years there have been exposed for sale in the markets of San Francisco * * * small Californian birds, * * * the so-called 'reed birds.' * * * A San Francisco 'reed bird' * * * generally speaking is a horned lark (*Otocoris*), known to the market men and pot hunters who furnish them as 'bean birds.' Fifteen years or more ago this bird was almost the only species killed for this purpose, but the long-continued, persistent slaying of this species, together with the increase of settlement, making it necessary to journey farther after them, has resulted in the substitution of most any other species of about the same size in place of them. * * * The annual destruction must amount to many thousands.

However, of recent years the economic value of horned larks has become better understood, and at present they are protected throughout the year in all but five of the States in which they regularly occur, and in no State are they specifically exempted from protection. In consequence comparatively few horned larks are now captured for food.

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[a] Hermann Fürst, Deutschland's nützliche und schädliche Vögel, p. 63, 1893.

[b] Zoe, II, pp. 142–144, 1891.

But man is not the only enemy of the larks. Because of the openness of the country they inhabit, they are always in more or less danger from hawks and owls, and the following species have been known to kill them: Red-tailed hawk, red-shouldered hawk, marsh hawk, prairie falcon, and burrowing and screech owls. Shrikes also capture them.

While the fondness of the horned larks for open country thus exposes them to the attacks of rapacious birds, in farming regions it leads them to live on cultivated land, where they enjoy the protection of man. Here they are but slightly affected by the farming operations which drive away many birds. They build their nests on the ground in exposed situations, and neither woods, shrubbery, nor other protecting growths are needed to induce them to nest on the farm. In spring the wheat fields, pastures, and meadows not yet rankly covered are chosen as nesting sites; early summer finds them with their second brood in the fields of young corn, and still more belated pairs make their homes in the stubble fields. In winter, feeding lots, barnyards, and all open fields are favorite foraging grounds, and often they may be seen searching for food along the much-frequented country road. For several years the writer knew of a meadow where these birds built their nests and reared their young. They fed in the adjoining road and in a cornfield opposite, and were to be found here the year through. From these facts it appears that at every season the horned lark is closely identified with the farm and thus with the farmer's welfare.

Of the birds examined for the purposes of this bulletin, and accompanied by full data, about four individuals were taken on farming land to one taken in uncultivated places. About one-half of the former number had eaten insects, somewhat over a third had taken grain of some kind, and practically all had eaten weed seeds. As explained elsewhere, most of the grain is obtained along roads and in stubble, and hence no injury is done to the farmer. Of the number found away from farming regions all had eaten weed seeds, nine-tenths had consumed insects, and about one-half had taken grain. Those larks which occur far from cultivated lands, while not directly beneficial to the farmer, undoubtedly aid him indirectly by destroying harmful insects and weeds which might spread to the farms.

VEGETABLE FOOD.

No less than 79.4 percent of the food of the horned larks is vegetable matter. Of a total of 1,154 birds examined only 22 had eaten no vegetable matter, while in some form or other it made up the entire stomach contents of 634. In this portion of the food are represented no fewer than 105 species of plants. This great variety may be classed for economic consideration under the following heads: Weeds, forage plants, fruits, and grain.

GRAIN.

Grain furnishes 40.2 percent of the food of the horned larks in California and 12.2 percent of that of the larks in the rest of the country. Oats, corn, and wheat form the bulk of this, kafir corn and buckwheat being taken in insignificant amounts.

Were all of the grain eaten by horned larks a direct loss to the farmer, the damage would be considerable. But such is not the case. As would be expected from birds so essentially terrestrial in habits, horned larks do not injure standing grain, nor do they feed upon grain in stacks and shocks. The grain they obtain from the surface is either newly sown seed or waste, and as the latter is lost to the farmer in any event, it is safe to conclude that whatever damage the birds do occurs in sowing time.

WHEAT.

Wheat is damaged more than other grain crops during the sowing season, and the injury is greater in California than elsewhere. Details of the ravages of the larks in this State are given by several correspondents. A. A. Eaton, of Riverdale, Fresno County, writes substantially as follows:

> I believe the worst pests in the bird line farmers have to endure are the horned larks. In winter they come in thousands and eat wheat sown broadcast so badly that I have had to drill it in. They leave the whole wheat, however, as soon as they find any that has sprouted. They then select spots, generally where there have been some weeds, and pull up, and even scratch, in the manner of a hen, the better to get at the whole. In such places not a stalk is left standing.

M. S. Featherstone, of Goshen, Tulare County, which is in the midst of the best wheat-growing section of the State, says:

> Small brown birds which we call wheat birds are quite numerous during the sowing season some years. Ten or twelve years ago they were unusually active, and many people sowed poisoned wheat and left it on top of the ground to destroy them before the regular sowing. I had about 4 acres left, not harrowed, one Saturday night, and every kernel was gone by Monday morning, picked up by the wheat birds and meadow larks. During the latter part of January and the first part of February last year (1895) wheat birds were plentiful and did much damage. The early sown grain was not injured by them. I put out some poisoned grain (a gallon or so), and my boys picked up about 600 in a few days. They also found 3 mourning doves and some meadow larks (a dozen or two). I think the wheat birds also pull up the sprouting grain. These little birds are yellowish on the throat and fly in flocks. I have not noticed them except in the early spring.

Mr. E. W. Nelson, of the Biological Survey, in writing about the California horned lark in 1893, stated:

> This species is excessively abundant in the San Joaquin Valley of California, east of Tulare Lake. In autumn they gather in enormous flocks, containing hundreds of birds, and continue together until spring. When the farmers sow their winter wheat on these plains the shore larks swarm over the fields in countless numbers, scratching up and greedily devouring the grain. They do this so persistently that fields are sometimes replanted on account of their depredations, and all fields are considerably damaged by them.

Such direct evidence as the above, from observations in the field, establishes beyond doubt that in wheat fields, newly sown broadcast, the horned lark is a pest, and this conclusion is corroborated by the results of stomach examinations.

Before discussing these it will be well to outline the conditions of grain raising in California. The Sacramento and the San Joaquin river valleys and the coastal region from San Francisco south are the important wheat-growing areas, and it is precisely in these places that the horned larks are most numerous during the second sowing time. This occurs in January and February, the first being late in summer (August and September) before the first fall rain, or immediately after it if the soil can not be worked before. Thus there are two periods in the year during which wheat is exposed to attacks of the larks.

Since horned larks are present only in small numbers during the first sowing season, the possibilities of injury from them are not great; moreover, that the birds present eat little wheat appears from the fact that none of it was found in the stomachs of any of the horned larks from California, in number over 150, which were collected from August to the end of the year.

During the winter sowing, however, the horned larks are abundant, and then it is that complaints are made of their wheat-eating habits, complaints which our investigations show are not unfounded. Wheat constituted 14.1 percent of the food of 21 birds collected in January and 74 percent of that of 5 birds taken in February. However, all of the wheat taken in January was in the stomachs of 3 specimens from Escondido, San Diego County, and it made 99 percent of their contents. The high percentage of wheat in the food in February is partly due to the small number of specimens examined, namely, 5. Three of these, however, were shot from a flock of birds which were 'supposed to be pulling wheat,' and thus were caught in the very act. These, also, were taken at Escondido, and contained an average of 93.3 percent of wheat.

These facts justify the conclusion that horned larks eat wheat whenever they can find it. It forms only 9.1 percent of the year's food of the California horned larks, but as most of this is seed grain the damage is greater than implied by the figures. However, it is to be noted that all of the wheat eaten at this time comes from fields sown broadcast, and that absolutely nothing is done by the farmers to protect the seed. The very best protective measure—drilling—costs no more than broadcasting, except for very small areas, and besides completely protecting the wheat from the birds, it has the further advantages that it increases the yield per acre and also improves the quality of the grain.

Joseph Mailliard, of San Geronimo, Marin County, Cal., writes (July, 1905):

> Grain is drilled in to quite an extent now, but the majority of the large grain fields are sown with the broadcasting machine on account of greater rapidity. This leaves more or less grain on and near the surface, which naturally falls a prey to certain species of birds when conditions are right. I should say that the horned larks would only attack grain when food was scarce in their own feeding grounds, which are usually grass-grown meadows and uplands.

Lyman Belding, of Stockton, San Joaquin County, who has had many years of experience in the California grain country, says (July, 1905):

> As far as my observation goes there is less wheat planted by drills late years than formerly.

Concerning the depredations of the larks he continues:

> I can say positively that the damage done by these birds in California is not worthy of the least consideration, because the shore larks are not numerous and we have millions of acres of wheat. Like our meadow lark and Brewer's blackbird, the damage done by them would only be noticeable on a small field of wheat that was much later than adjoining wheat fields; but, unlike the meadow lark and blackbird, it does not probe the ground for the wheat kernel—it merely eats a little wheat that is on the surface of the ground not yet covered by the harrow in seeding time. I have observed them closely in Butte and this county, and am positive the statement made above is correct.

Comparing the above with previous quotations it is seen that opinions differ concerning the economic status of the horned larks, but that at the present time the consensus of opinion is favorable to the bird.

It appears that injury from the larks is suffered also in the spring-wheat region of the central plains. Charles L. King, of Millbank, S. Dak., writes:

> There is a bird called wheat bird * * * that comes in early spring in great numbers when the farmer is sowing grain, and all grain left on top of the ground is very soon picked up.

T. P. Lindley, of St. Ansgar, S. Dak., corroborates this by the following testimony:

> The worst birds we have in Dakota are small prairie birds. They eat wheat while it is being sown. They are small, but so numerous that they take one-third to one-half of the crop if it is left uncovered for a day or two. They do not dig the wheat out, but pick it up before it is covered.

In the following letter George Lang, of Indian Head, Assiniboia, describes the depredations of the lark in greater detail, and points out that the use of deep planting drills has rendered the birds harmless:

> The damage is done as a rule about the first two weeks in May while the wheat is in the first leaf. I have examined the stomachs of hundreds of specimens, and in almost every case I found grains of wheat. These birds, in company with snow buntings and chestnut-collared buntings, are here in millions from about April 15 to May 15. They pick up all uncovered kernels first and then as soon as the young shoots appear above ground they follow up the rows and pull up the stalk, eating only the sprouted kernel, and leave the leaf lying on the ground. Of course they break off a great many more than they uproot, but still they thin out the grain to quite an extent. In earlier years, before we began using drills for seeding wheat, we always counted on one-half bushel to the acre for the grain birds, as we counted they would pick up that amount. I know of fields that had to be seeded over the second time where the harrows were not kept close up to the seeder. I have also been driven to poisoning wheat and scattering around the fields. Of late years we do not notice these birds so much. I suppose on account of the increased acreage the birds are more scattered, and also on account of the press drills putting the seed too deep for the birds to uproot.

As in the case of the California larks, stomach examinations confirm field observations with regard to the grain-eating habits of the larks of the central plains wheat region. Of 23 stomachs of horned larks collected here in April and the same number in May, 46 in all, 11 contained wheat. Seven of these were collected on April 5 in a newly sown wheat field at Kennedy, Nebr., and all held wheat. The average amount for the 7 was 28.4 percent, and no individual had taken more than 35 percent. The remainder of the food was weed seeds. These were seeds of sunflower, tumbleweed, and pigweed. Thus the birds which had made something over a fourth of their meal of wheat had eaten nearly three times that amount of the seeds of the worst weeds in the country. If fully a third of their food had been wheat, the average percentage of grain for the whole 46 would be only slightly over 7 percent, an amount clearly too trivial to warrant the condemnation of the birds, especially in view of the fact that the remainder of their food consists of the seeds of noxious weeds.

It is of importance to note that the complaints quoted above were made several years ago when broadcast sowing was the rule. Recent correspondence shows that drilled fields of wheat are practically safe from injury by the birds.

CORN.

Corn constitutes 4.97 percent of the food of the horned larks. Since it is always planted rather deeply, seed corn is quite out of their reach, and even grains lying on the surface in a condition to germinate are probably not eaten by these birds, since the grain is too large to be swallowed whole, and their weak bills are entirely inadequate to the task of breaking up the kernels. The writer watched horned larks feeding on prairie land in Indiana where many whole grains of corn were scattered about, and found that they passed them by.

Nearly all of the corn consumed is obtained in the winter, and none is eaten in August, September, and October. Many fragments taken in winter are exceedingly hard and apparently are not much affected by digestion, and the larks would certainly fare badly if much of their food were of this character; but gleaning constantly as they do along the roads, in barnyards, and feeding lots, they get many fragments of corn from the droppings of farm animals. From these sources, and from fields where the grain has been crushed by the tires of wagons and the hoofs of cattle, comes a great part of the corn they consume.

Consideration of the above facts shows that practically all of the corn eaten by the horned larks is waste, and hence is of no value to the farmer.

OATS.

Oats constitute the greater bulk of the grain eaten by the horned larks, and it is of interest to note that the major portion of this grain taken, as well as that of wheat, is consumed by the horned larks of California. The latter eat oats to the extent of 31.1 percent of their food, while in the rest of the country the larks consume only 4.86 percent. During sowing time in the country east of the Rockies only a small percentage of oats is eaten. One bird was collected in a newly sown oat field in Michigan, March 31, and no trace of oats was found in its stomach.

Nearly nine-tenths of all the oats consumed in the year are eaten during the months from September to January, inclusive. In the Eastern States all grain eaten at this season is waste, but as the sowing in California occurs in October or in February, oats eaten in this State during these months may lessen the crop. No horned larks were collected in newly sown oat fields in California, but from data accompanying the birds it seems that stubble feeding is a common habit from October to January. Where the ground is broken up every year the stubble grain is of no consequence; but if a volunteer crop is depended on, then every grain taken from a stubble field lessens the succeeding crop. Even in the latter case, where it must be admitted that the larks do a certain amount of injury, it must not be forgotten that they eat ants and weevils which are injurious to crops, and that they devour the seeds of weeds which might render the hay crop almost worthless.

Oats grow wild everywhere in California and are inclined to remain tenaciously on ground once occupied. Professor Beal, after studying conditions in this State, considers that, in general, oats found in the stomachs of California birds should be regarded as weed seed. Wild oats and those wasted in handling the cultivated crops must furnish practically all of this grain eaten by these larks, since there appears to be no evidence that they injure cultivated oats at any time.

OTHER GRAINS AND FORAGE PLANTS.

Buckwheat is the most important of the other grains eaten by horned larks. All of it is consumed in June and July, and it may be, therefore, scattered grain from the early crop, or seed sown for the later one. Only nine birds of the entire number examined had eaten buckwheat, and it constitutes but little more than one-half of 1 percent of the food of the year. Kafir corn and other sorghum seeds were eaten by some of the horned larks, but altogether they make up less than 1 percent of the total food, and all of this must be waste grain.

Some slight injury to a few of the forage plants may be mentioned here. Professor Barrows in his report noted the case of about sixty birds which were taken in a newly sown millet field in Michigan. Most of these birds had eaten millet seeds to some extent. This is the only instance noted in which the horned larks are known to have eaten cultivated millet, though they eat great quantities of the seeds of the wild species. Some grasses of the genus *Paspalum* are included among the forage plants, but most of these are unmitigated nuisances as weeds. To sum up this part of the subject, it may be said that if any injury to forage plants is done by the horned larks, it is too trifling for serious consideration.

The loss to grain growers through the agency of the horned larks is not, however, to be waived aside as of no moment. While it is true that on most farms in the United States enough grain is wasted to feed all the wild birds that occur on them, sometimes grain is eaten that is not waste, as in the instances above cited. Admitting, then, that the shore larks destroy a certain amount of grain, it may be said that whenever the damage to crops by birds is excessive there is an easier as well as a better method of dealing with them than by their wholesale destruction. It is the part of good husbandry to build and keep in repair fences about grain fields to prevent cattle from injuring the crops, and no one thinks of shooting the animals when they break through. We simply strengthen the defenses. The birds should be dealt with in the same fair-minded way, having due regard to the fact that they are generally useful and valuable allies, and that the damage they occasionally do can be rendered insignificant or wholly prevented by simple and inexpensive means. The use of a modern press drill in sowing grain is the best of these, and is sufficient in itself to prevent practically all of the damage to grain crops by the horned larks.

Finally, it may be said in the bird's favor that at the worst the damage to grain from the horned lark is not great, and that it is more than counterbalanced by the good done through the destruction of harmful insects and the seeds of injurious weeds.

WEEDS.

The plants commonly known as weeds, from their injurious effect upon agriculture, are more important than any of the other enemies of the farmer. They rob the soil of its nutritive elements and of its moisture, and thus reduce the size of crops. They are mostly hardy, vigorous plants, and shade and choke out the more delicate plants of cultivation. Many fungous diseases of cereal, fruit, and other crops, such as rusts and rots, depend for their continuance upon weeds as intermediate hosts. Such weeds as the mustards are especially well known as the primary hosts of rusts. Some weeds poison stock; the spiny seeds or burs of others lessen the value of wool, besides being the cause of annoyance to all animals on the farm and to man. In these and in a thousand other ways weeds injure the farmer. They are present everywhere, and their numbers are limited only by the capacity of the soil and the extent of available space. Passing to particular examples of their fecundity, we may mention that a single plant of foxtail (Plate II, fig. A), the seeds of which were eaten by nearly 350 of the horned larks examined, has been known to produce 113,000 seeds, and a plant of red root (tumbleweed), the seeds of which are the food next preferred, has produced 115,000 seeds. Such reproductive powers if unchecked would result soon in covering the entire surface of the earth with weeds. Even as it is, the surface soil contains so many seeds that they often seem to constitute a considerable percentage of its bulk. At Ames, Iowa, a square rod of ground in a garden, which had been in potatoes the year before and cultivated with a hoe, yielded 187,884 plants of eight common weeds.[a] Crab grass and its allies, which are great pests in permanent lawns, and the seeds of which are eaten freely by the horned larks, occur in even greater number. Professor Beal states that each square quarter of an inch in his garden in Maryland, when first cultivated in the spring, contained at least one plant of crab grass. Upon this basis the number of plants to a square rod is 627,264. Three times the weeds were cut off, but each time they appeared in as great numbers as before.

The above statements indicate the vast numbers of weeds on farms, and show that to prevent them from possessing the land they must be destroyed in all stages of growth. The damage they cause, reckoned in dollars and cents, is enormous. The Botanist of the Department of Agriculture says:

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[a] Bulletin No. 70, Exp. Sta., Ia. State College, p. 465, 1903.

> The direct loss in crops, the damage to machinery and stock, and the decrease in value of land due to weeds, amount without question to tens of millions of dollars each year—a loss sustained almost wholly by the farmers of the nation.[a]

To limit the loss caused by them an unending warfare must be waged by the farmer. Any allies in this defensive warfare should be welcomed, and of such allies the seed-eating birds are the most important. The farmer, by the expenditure of time and labor, can destroy the weeds when they have sprouted, or later before they have ripened seed. But the seeds which are on and in the ground and which remain there for an indefinite period awaiting favorable opportunity for germination, it is not practicable for man to destroy. This portion of the work the birds attend to, and among the birds most actively engaged in consuming weed seeds the horned larks are conspicuous. Weed seeds are by far the largest single component of their food (63.9 percent), and over 1,070 birds of the number examined had eaten them, no fewer than 206 individuals having fed upon them to the exclusion of everything else. There can be no doubt of the fact that the horned larks display a preference for weed seeds and depend upon them as the *pièce de résistance* of every meal.

The larks, unlike some other species, do not perch upon weeds and peck apart the heads, thus assisting in scattering the seed, and it is in the last degree improbable that any of the seeds they eat pass through the alimentary canal in a condition to germinate. They have strikingly large and muscular gizzards, which seem specially adapted to dealing with hard and tough-coated seeds, and, moreover, they eat a great quantity of gravel. It has been found that as the result of the combined action of the gizzard and the gravel every kind of seed eaten by this lark is crushed. Even the exceedingly hard nutlets of *Lithospermum* succumb to its action. Cherry pits, which are very hard and of a shape most difficult to crush, are broken; minute seeds, such as those of amaranth and oxalis are ground up, and their fragments in the stomach resemble red pepper. Among the weeds the seeds of which furnish grist for these destructive mills are some of the worst pests in the country. Of a list of 100 weeds which are regarded as the most troublesome in the United States, the seeds of no fewer than 38 are included in the diet of these birds. Of this number the foxtail grasses, smartweeds, bindweeds, amaranth, pigweeds, purslane, ragweed, and the crab and barn grasses are conspicuous. The seeds of foxtail head the list, being found in 347 stomachs examined. Over 300 birds had eaten the seeds of amaranth (fig. B) and nearly 260 those of pigweed.

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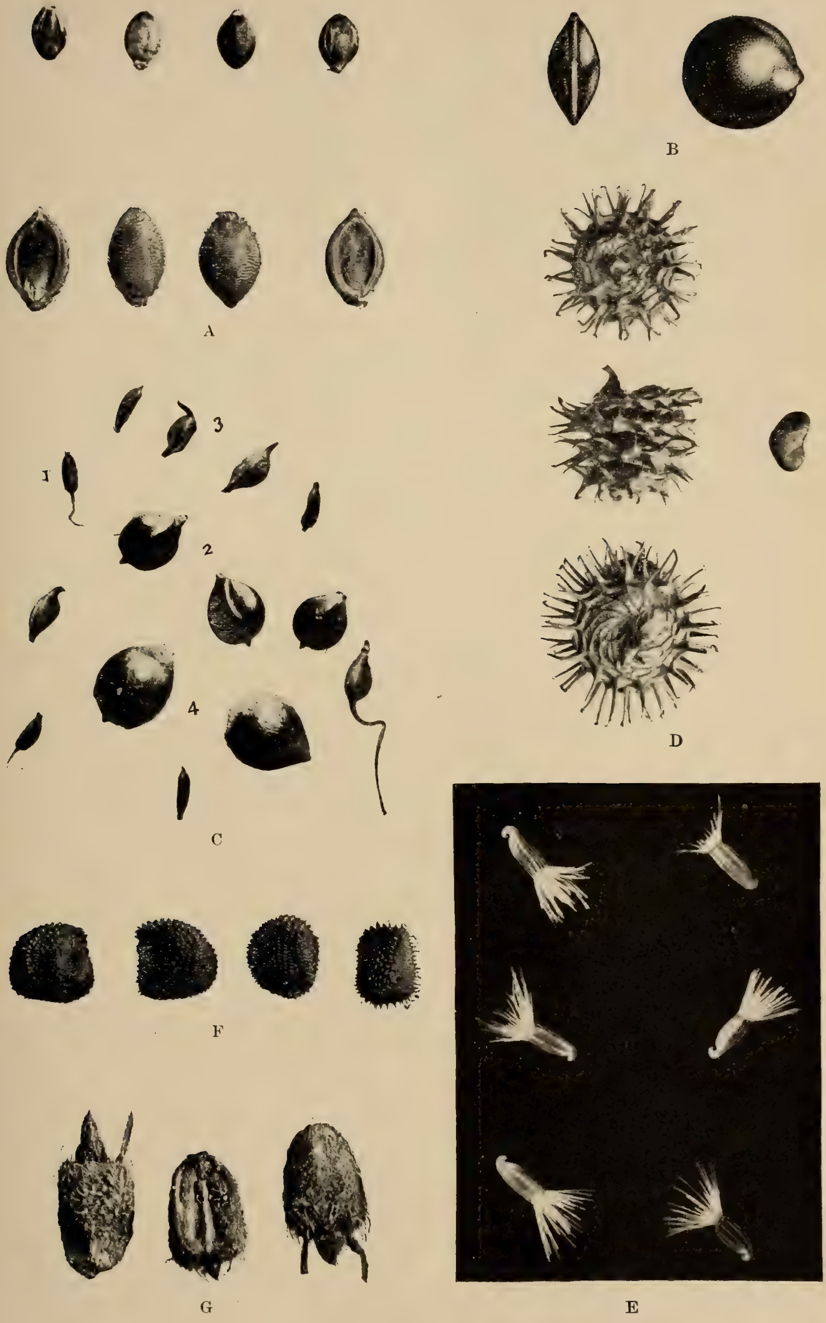
[a] Coville, in Farmers' Bulletin No. 28 (Weeds; and how to kill them; by L. H. Dewey), p. 3, 1895.



SEEDS OF CERTAIN TROUBLESOME WEEDS EATEN BY HORNED LARKS.

Fig. A.—Green and yellow foxtail (*Chætochloa viridis* and *C. glauca*). Fig. B.—Amaranth (*Amaranthus blitoides*). Fig. C.—Sedges (1, *Cyperus;* 2, *Scirpus;* 3, *Carex;* 4, *Rhynchospora*). Fig. D.—Bur clover (*Medicago denticulata*). Fig. E.—Napa thistle (*Centaurea melitensis*). Fig. F.—Corn cockle (*Agrostemma githago*). Fig. G.—Button weed (*Diodia teres*).

[A, F, G, Magnified 4 times; C, D, E, magnified twice; B, magnified 17 times.]

Smartweed and bindweed were eaten by 187 birds, crab grass by 154, and the seeds of sedges by more than 150.

The last are harsh, coarse plants, unsuited for forage, but which often adulterate forage crops injuriously. Grass and sedge seeds (fig. C) form 26.21 percent of the food of the horned larks. Some of these seeds are very small, and a great number of them are taken by the birds at a meal, no fewer than 500 having been found in a single stomach. An equal number of the tumbleweed seeds have been eaten by one bird, but of most kinds 100 is a fair meal, and this number of foxtail seeds is often taken. As a rule, however, the horned larks do not make an entire meal of one kind of food, nor do they show a decided preference for particular weed seeds, as appears from the very large number of kinds eaten, no fewer than 90 species of weed and grass seeds having been identified in their food.

Besides the common weed pests before mentioned, many other weeds, harmful in some or all parts of the country, are comprised in this list. Black mustard and wild radish, common pests in grain fields, are eaten whenever found. These weeds are especially injurious in California. Some others, which are only too well known in the same State, are eaten freely by the horned larks. The little plant known as red maids (*Calandrinia*), which is very hard to extirpate, produces a myriad of small black seeds, which are a favorite food of the larks of California. Filaree (*Erodium*) and the chickweeds (*Silene* and *Stellaria*) are very persistent weeds in cultivated ground, and again, their seeds form a conspicuous portion of the food of the horned lark. Bur clover (*Medicago denticulata*) (fig. D), very injurious to sheep-raising interests, and the Napa thistle (fig. E), or tocalote (*Centaurea*), a most formidable weed pest in both fields and pastures, are eaten. The common sunflower, harmless in the East, but most troublesome in many parts of the West, has large, nutritious seeds, which are often found in the stomachs of the larks. Dandelion, hoary vervain, and dog fennel are three others of the list of the '100 worst weeds' which are eaten. The seeds of plants of the genus *Solanum* also, one of which is the troublesome horse nettle, though small, are not overlooked. Among the poisonous plants the seeds of which are a part of the food of the horned larks is corn cockle (*Agrostemma githago*) (fig. F). The seed of this plant is a serious component of the wheat crop, as its weight and size make its separation from the wheat difficult. Animals are sometimes poisoned from eating wheat with cockle in it, and fatal cases of poisoning have been known of men who had eaten flour made from such grain. The birds apparently are not affected by the poisonous qualities of the seeds. Corn cockle is also a bad crop-choking weed, and in eating its seeds the larks confer a double benefit. Pokeweed, another poisonous species, sometimes injurious to cattle, produces seeds which are eaten by the horned larks. Lamb's quarters, buttonweed (fig. G), whitetop, and corn spurry are among the other well-known weed seeds consumed.

Fruit.

A few seeds of cultivated fruits were found in the horned larks' stomachs. These were of blackberry, pear, and cherry. No fruit pulp was found, and the seeds were probably obtained from garbage heaps, where these birds sometimes feed. But one-fifth of 1 percent of the total food of the year is fruit, and nearly all of this is taken in the winter months. Evidently the horned larks have little taste for fruit, and the quantity they get is too insignificant to be of economic value.

Miscellaneous Vegetable Food.

Among the miscellaneous vegetable matter of no economic importance eaten by the larks were bits of grass roots and stems, a few flowers, and fragments of other tissues of plants. One stomach contained algæ, which had been obtained in a marsh. A few seeds, recognizable only as those of plants of the mint and carrot families, were found. Giraud reports that he found bits of seaweed in the stomachs of larks.

In summing up this part of our subject it may be said that horned larks are among the most efficient weed-destroying birds, and, as we have just seen, not a few of the weeds they eat are among the worst pests of cultivated land.

ANIMAL FOOD.

The animal food of the horned lark, comprising 20.6 percent of the yearly diet, is made up entirely of invertebrates. It consists principally of insects, but is of great variety, as appears from the following list: Beetles, butterflies, grasshoppers, moths, ants, spiders, flies, wasps, thousand-legs, mites, centipedes, snails, periwinkles, bits of crab, mussel, and oyster shell, earthworms, termites, and ant-lions. Not only are the adult forms of the above eaten, but also the eggs, cocoons, and larvæ of many of them. Thus the horned lark does effective work in thinning out many forms of invertebrate life.

Insects.

There are more harmful than beneficial families of insects, and the influence of the injurious kinds greatly overbalances that of the others. Many species, however, are valuable allies of the farmer, and successful agriculture would be well-nigh impossible without them. For the purposes of economic ornithology, only a few groups are considered beneficial. These are chiefly the parasitic hymenoptera, which destroy many injurious insects, and the predaceous beetles. That the latter are not entirely useful, and that they sometimes attack cultivated crops, has been shown by various authors. These insects together make up only one-fourth of 1 percent of the food of the horned larks, which may be said, therefore, to eat practically no insects of value to man. Predaceous beetles of one family, the *Carabidæ*, live on the surface of the ground, where the horned larks obtain all their food, and it is strange that so few are eaten. As these insects are usually active only at night, and remain concealed by day, they are well protected; but some birds eat considerable numbers of them. Of the few found in the stomachs of horned larks only one species, *Agonoderus pallipes*, can be identified. This beetle (fig. 3) is known to feed upon the chinch bug, but about half of its food is vegetable, partly grass seed. Its economic relations, then, are about evenly balanced, and its wholesale destruction would be a loss. Only 15 of the 1,154 birds examined had eaten any carabids, and these insects represented but 0.16 percent of the total food. Thus the destruction of these insects by the horned lark is too slight to be noticed. Tiger beetles, another group of predaceous beetles, are also very scantily represented in the food of the horned larks. Although the larks often feed on the sandy beaches and roads where these active insects are most abundant, only two of them had been secured by the birds examined.

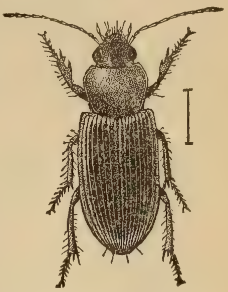


FIG. 3.—Predaceous beetle (*Agonoderus pallipes*). (From Riley, Bureau of Entomology.)

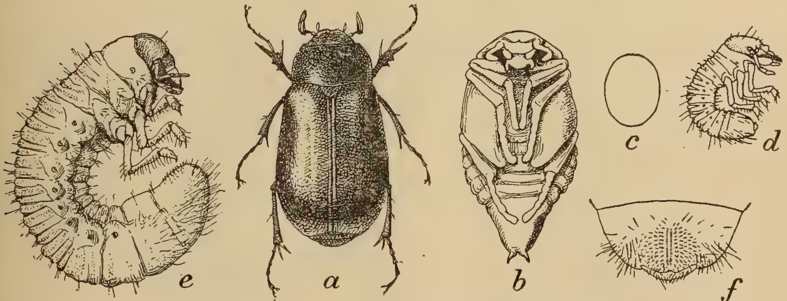


FIG. 4.—June bug (*Lachnosterna arcuata*) and its larva, a white grub. (From Chittenden, Bureau of Entomology.)

Taking up the injurious species, it was found that several horned larks had eaten click beetles, both in the adult and larval stages. The larvæ are the wireworms which are injurious to grain crops. The greater number of these were eaten in May. Among other beetles eaten, the dung beetles and other scavengers of the family *Scarabæidæ* are of little economic interest, and together with the leaf chafers of the same family they comprise a little over 1 percent of the food of the year. All the leaf chafers, however, which include the June bugs (fig. 4) and their larvæ, the white grubs, are injurious. In the month of May 8.75 per cent of these are taken. The leaf beetles or chrysomelids form a slightly larger portion of the food taken than the scarabæids. The largest percentage, 4.1, of these eaten in any month is in August. In this family are found the harmful flea beetles, several species of which have been identified from stomachs of horned larks. *Haltica ignita*, which it is thought is likely to become decidedly injurious to strawberries and other plants in many parts of the country, and *Phyllotreta vittata* (fig. 5), a species very destructive to young plants of cabbage and other garden vegetables, are eaten by the larks. The pale striped flea beetle (*Systena blanda*) (fig. 6), injurious to melons, sugar beets, etc., has been found in their stomachs. Passing to another family, the blister beetles, which often feed upon the leaves of potato vines, are also eaten by the horned larks.

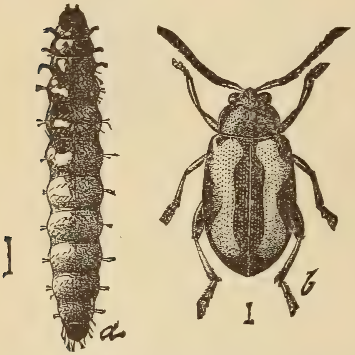


FIG. 5.—Destructive flea-beetle (*Phyllotreta vittata*). (From Riley, Bureau of Entomology.)

The most conspicuous element of the insect food, however, is weevils. These dull colored little beetles are eaten in every month in the year, and comprise 4.5 percent of the entire food of the horned larks. In May and June they form more than 8 percent of the food, and in August 18 percent. One hundred and fifty-nine birds ate them to the extent of 28.7 percent of their food. The weevils, as above stated, are dull and protectively colored, and when disturbed feign death and drop to the ground, where their resemblance to bits of twigs or seeds enables them to escape detection. This device, however, seems to be of little avail when the sharp eyes of the horned larks are concerned. Most of these little beetles are injurious, and some are among the worst of pests. The imbricated-snout beetle (fig. 7), which injures apple and cherry trees and strawberry plants, is often eaten. Eight California larks devoured more than 45 yucca weevils, the birds having an average amount of 84 percent of these insects in their stomachs. Of the curculionids, or true snout beetles, *Sitones* injures grass roots and *Phytonomus*

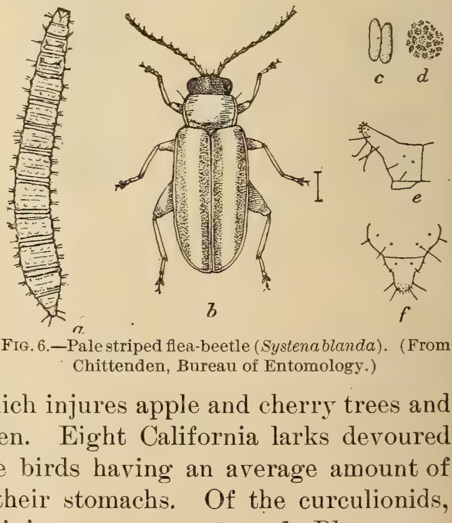


FIG. 6.—Pale striped flea-beetle (*Systena blanda*). (From Chittenden, Bureau of Entomology.)

attacks clover. Both of these beetles are eaten by the horned lark. The potato stalk borer (*Trichobaris trinotata*), the nut weevils, and grain weevils are all taken. Weevils in the lark's diet take the place of grasshoppers, which are the predominant element of the insect food of granivorous birds. The percentage of grasshoppers eaten by the larks, 2.5, is somewhat more than half that of the weevils consumed. In August and September, the months during which grasshoppers are most abundant, 7.1 and 8.9 percent, respectively, are consumed by horned larks. Grasshoppers were obtained in every month in the year except November, December, and January. During the great invasions of locusts that have occurred in the United States horned larks have been efficient in their destruction, and they are reported to have eaten both eggs and adults.

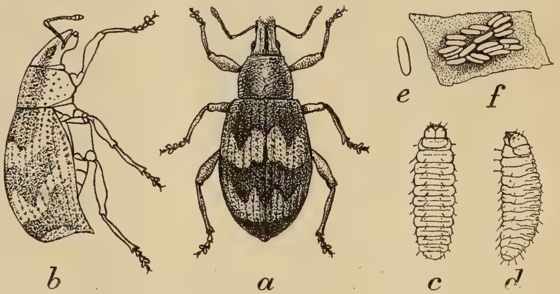


FIG. 7.—Imbricated-snout beetle (*Epicærus imbricatus*). (From Chittenden, Bureau of Entomology.)

Caterpillars, cocoons, and adults of lepidoptera are eaten by horned larks. The larvæ of the tineid or leaf-mining moths (fig. 8), which are injurious to various nuts, fruits, and stored grain, and even to furs, are a favorite food. In the winter many of these are picked from their places of concealment. Three horned larks collected in March in Wyoming had eaten more than 30 each, making 80 percent of their food. Among the caterpillars, geometrids, or measuring worms, were identified. Most of the caterpillars are eaten in April and May, 5.8 and 6.2 percent, respectively, being taken in these months. Concerning the value of the horned lark in destroying cutworms, the caterpillars of the owlet moths, Dr. Le Baron says:[a]

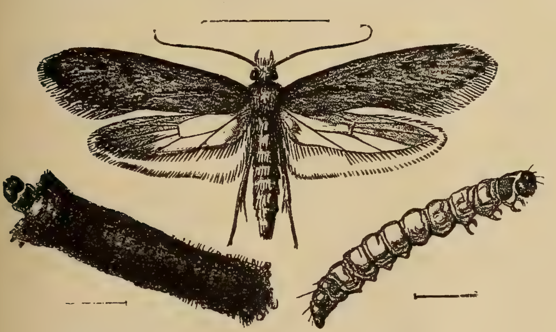


FIG. 8.—Tineid moth with larva and cocoon. (After Riley, Bureau of Entomology.)

> The peculiarity of this bird * * * is the instinct with which it discovers and destroys those grubs which infest cornfields, and which often do so much damage to this and other crops. It came to my knowledge through the observation of an

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[a] The American Entomologist and Botanist, II, No. 6, p. 168, April, 1870.

intelligent and observing farmer in my neighborhood upon whose accuracy entire dependence can be placed.

While going through with the first hoeing of his corn, he observed running about among the hills little grayish birds, which, from his description and from the absence of any similar bird with which it could be easily confounded, I have no doubt was the present species. Upon observing one of them more attentively, he became interested in watching its operations. Running along near the hills, it stopped abruptly from time to time opposite a hill and stood still as if listening; then, having apparently determined its direction, it inserted its bill at a short distance from a spear of corn, and by a rapid rotary motion partially buried itself in the loose earth, and then jerking backward dragged out a large grub, which from its situation may be reasonably supposed to be one of those larvæ, of which there are several different kinds, known by the name of cutworms. Taking this worm in its bill, it ran along until by its acute sense of hearing or by some other instinct it became aware of the presence of another of its insect prey. Then laying down the one previously obtained it quickly dislodged another in the same manner, and seizing them both in its bill again pursued the search. Having obtained as many as it could carry, it flew off to the neighboring grass field, having in all probability a brood of young awaiting its arrival. Not infrequently one of these small birds would carry off four or five grubs at once, often having to lay them down and take them up several times before it could get secure hold of them all.

When we consider how common these birds are, it is easy to conceive that they must destroy an immense number of larvæ in the course of the season.

While writing this article I have obtained several specimens of this kind of bird, both male and female, for the purpose of identifying the species with certainty. Upon examining the contents of the stomach, I found in most of them several grains resembling hulled oats, and in one of them was a larva nearly 1 inch in length, of a pale-green color, with a brown head and tapering a little at each end, being different from the cutworm, but resembling and perhaps identical with the spindle worm, so called, which burrows into the stem of the corn plant. It would be a curious fact if it should prove that the bird possesses the instinct to detect and destroy two noxious larvæ so different in appearance and habits as those here mentioned.

Thus does this shy and unobtrusive little bird perform its humble but useful part in the economy of nature, and while seeking a subsistence for itself and young unconciously renders an important service to the husbandman.

Next in importance to the beetles as an element of the horned lark's food are bugs. Eggs, young, and adults are eaten, and representatives of 12 families of these insects had been consumed by the birds examined. Practically all the bugs eaten are injurious, some of them especially so. The tarnished plant bug (*Lygus pratensis*) (fig. 9), which is very destructive to all orchard fruits and to strawberries, and the green tree bug (*Nezara hilaris*), one of the offensive stinkbugs sometimes found on grapes, are devoured. The chinch bug (*Blissus leucopterus*) (fig. 10), among the worst of all insect pests, was eaten in March, May, and June. The losses caused by this insect have been estimated for single years throughout its range at above a hundred million dollars. One stomach of a horned lark collected in May contained 34 entire chinch bugs and fragments of 16 more, or a total of 50 eaten in a morning.

Among other insects, ants and wasps taken together are but little over one-half of 1 percent of the year's food. The beneficial species consumed were ichneumon flies, but they make up only 0.07 percent of the total food. Ants at certain times are eaten freely, especially by California larks. These insects are considered more injurious than beneficial. None of the other components of the animal food amounts to 1 percent of the food of the year. Spiders are obtained in every month, the greatest number being taken in May. Flies and their larvæ are eaten whenever found, the greatest number in June. Dipterous larvæ, which live in the brine of salt tanks on the Pacific coast, are among those eaten, 20 of these being found in one stomach. Thirty-three larvæ of the common house fly were eaten at one meal by another bird. Termites or white ants were devoured by California larks in October, and the creatures known as ant-lions (*Myrmeleonidæ*) were a part of the food in May, June, and July, most of these being eaten by Kansas horned larks.

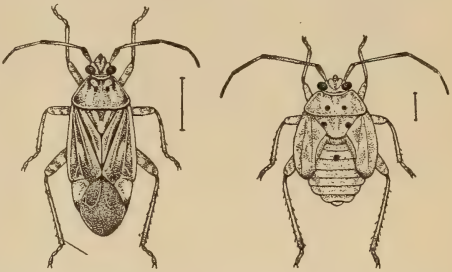

FIG. 9.—Tarnished plant bug (*Lygus pratensis*). (From Chittenden, Bureau of Entomology.)

MISCELLANEOUS ANIMAL FOOD.

Twenty-two birds had eaten animal matter which may be classed as miscellaneous. One had eaten three or four earthworms. Fragments of hundred-legs and thousand-legs were found in a few stomachs. A mite was found among some algæ picked up by one of the birds. Several larks which were shot on beaches had gathered a few small periwinkles, but whether these were taken for food or as an aid in grinding food is a question. Bits of oyster, mussel, and crab shell were probably taken for the latter purpose. One or two snails also were eaten.

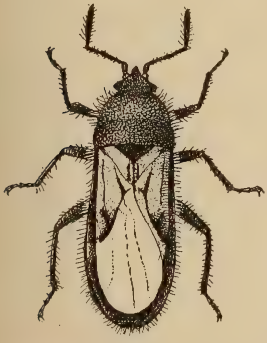

FIG. 10.—Chinch bug (*Blissus leucopterus*). (From Webster, Bureau of Entomology.)

So far as its animal diet is concerned, the horned lark is exceedingly beneficial. It consumes more or less animal matter in every month of the year, and from May to August nearly one-half its food is of animal nature, chiefly insects. These consist largely of species which if unchecked would soon render agriculture impossible. Feeding as it does on the ground in the midst of the crops which the insects threaten to destroy, the horned lark is one of the most efficient natural checks upon their numbers, and it is difficult to overestimate the value of the service thus rendered.

MINERAL MATTER.

Horned larks use a very large amount of gravel to assist in grinding their food, and, strange as it may seem, nestlings have more of it in their stomachs than adults. Five stomachs of nestlings which contained no food material except of an animal nature held an average of 21 percent of gravel. Now, it has been supposed, since granivorous birds usually eat much gravel, and since exclusively insectivorous birds, such as cuckoos, take almost none, that its function is the crushing and grinding of seeds to aid in their digestion. But why the thin-walled stomach of fledglings which are fed almost exclusively on soft animal foods should contain so much gravel is a question for which no satisfactory answer has yet been found. The percentage for the nestlings is 21.8, for the adults 18.4, and for the birds in first plumage 14.9. The last group is the most vegetarian of the three, but, oddly enough, takes the least grinding material. The mineral matter consists principally of coarse and fine sand, sandstone, quartz, and cinders. Many bits of fossils were found, among which were fragments of foraminifera, brachipods, sea urchins, corals, bryozoans, and crinoids.

NESTLING AND OTHER YOUNG HORNED LARKS.

As with most of our common birds, nestlings of the horned larks are more insectivorous than older individuals, although while still in the nest they are sometimes fed considerable vegetable matter. From the present investigation the ratio of vegetable to animal food is found to be 16.3 to 83.7.

A thorough study of the diet of the nestling larks requires a larger amount of material than is available. Ten stomachs have been examined, which were taken in three States, from April to July, inclusive. Those obtained early in the season, and from northern States, contained the largest amounts of vegetable matter. Of these, three contained 1, 8, and 40 percent, respectively, and two 50 percent, of vegetable substances. A nestling taken in April in New York had been fed 45 percent of wheat. This consisted of whole grains, which would seem to be rather unsuitable food for a fledgling. The other vegetable matter found in the stomachs of nestling larks was mainly weed seeds. Among them were green foxtail (*Chætochloa viridis*), tumbleweed (*Amaranthus*), and yellow sorrel (*Oxalis stricta*).

In the animal matter were wireworms (*Elateridæ*), other beetle larvæ, mainly white grubs (*Scarabæidæ*), adult beetles, such as scarabæids, leaf beetles (*Chrysomelidæ*), pill beetles (*Byrrhidæ*), and weevils (*Rhynchophora*). The latter were found in all but three of the stomachs and formed 16.3 percent of the total food of the nestlings. Of the chrysomelids, one stomach contained fragments of at least 50 individuals of the greater striped flea-beetle (*Disonycha caroliniana*) (fig. 11), a foliage-feeding species. The most important element of the animal food, however, was grasshoppers (*Acridiidæ*). These comprised 41.5 percent of all the food, and no less than 99 percent of the contents of one of the stomachs. Grasshoppers are a favorite diet for the nestlings of many birds, and sometimes are fed to them almost to the total exclusion of other foods. Prof. Samuel Aughey, in Nebraska, during the month of May, found the horned larks feeding almost wholly upon young grasshoppers, great numbers of which they were carrying to their nestlings. The stomach of one lark was found to contain 42 locusts and 33 small seeds.[a]

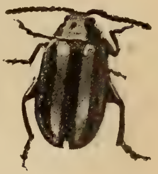

FIG. 11—Greater striped flea-beetle (*Disonycha caroliniana*). (Three times natural size.)

Other animal matter fed to the nestlings examined by the writer consisted of chrysalids of leaf-mining moths (*Tineidæ*), leaf bugs (*Capsidæ*), spiders, ant-lions (*Myrmeleonidæ*), thirteen of which formed 60 percent of the contents of one stomach, and centipedes (*Chilopoda*).

In the nestling state, therefore, horned larks are almost entirely beneficial, and the number of insect pests they consume is very great. Adults have been seen to carry food to the nest twenty times in an hour, and they continue their visits throughout the day for a week or more; and it is to be remembered that this species raises two or three broods in a year. Each family thus destroys a host of insects, and the quantity consumed by the birds throughout North America is almost beyond computation. As our examinations show that weevils and grasshoppers compose the great bulk of the insect food of the nestlings, their economic value can hardly be overestimated.

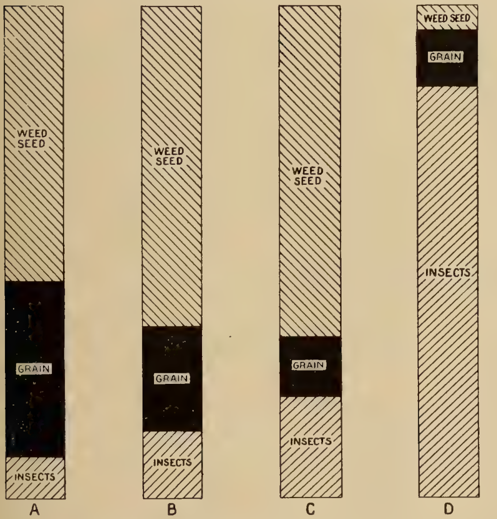

FIG. 12.—Columns showing the proportions of insects, grain, and weed seed eaten by the following: A, California larks; B, larks in first plumage; C, total number examined exclusive of California birds; D, nestlings.

Concerning the fully fledged young, Professor Barrows noted that they eat less animal matter than the adults, a conclusion confirmed by examination of the more abundant material now available (see fig. 12).

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[a] First Ann. Report U. S. Entom. Comm., App. II, p. 18, 1878.

One hundred and four birds in first plumage were taken in seven of the twelve months. The average amount of animal food eaten by them was 13.47 percent, 7.15 percent less than the quantity consumed by the adults. There is, in fact, no month in which they do not eat less animal matter than the old birds; thus in January they get none at all, in May they consume not quite 1 percent less than the adults, in June 25.1 percent less, in July 5.81 percent less. In August three young birds had eaten an average of only 0.5 percent of animal food, which is over 43 percent below the amount taken by the adults in the same month. In September three birds obtained 5.33 percent, or 9.27 percent less than the old birds. In October only one immature bird was collected, and it had eaten 5 percent of animal matter, which was more than 9 percent less than the average amount taken by the adults during that month.

In May, June, and July the birds of the year, although they consume less animal food than the adults, get more than the average amount for the species, and perhaps they are fed to some extent by the adults. In August, September, October, and January, as we have seen, they either care little for animal food or, as is more likely, are unable to procure it from want of skill. The latter conclusion seems all the more probable, since it is in the first-named month that the adults consume the maximum amount for the year.

If comparison of the animal food of adults and young (exclusive of nestlings) is confined to the months in which the latter were collected, the young fall more than 15 percent below the average of their parents, and, be the reason what it may, the fact remains that in the month of January and from May to October, inclusive, the birds of the year consume less than half as much animal matter as the adults.

FOOD OF THE HORNED LARKS OF CALIFORNIA COMPARED WITH THAT OF THE OTHER FORMS.

The food habits of the California subspecies (*Otocoris alpestris actia*) were found to differ so remarkably from those of the other horned larks as to merit separate notice. Briefly stated, the difference consists in the high percentage of vegetable—as compared to the animal—food consumed by the California birds. Proceeding to details it will be seen from the accompanying chart (fig. 13) that the quantity of animal matter consumed fluctuates irregularly throughout the year, obeying no obvious law. No stomachs were collected in May, and the number for some other months is too small to furnish reliable results, but the aggregate for the year, 267, is quite sufficient to give a good idea of the food of the subspecies.

No nestlings of the California lark were examined. The first brood of these is said to be hatched in April or May, and the percentage of animal matter consumed by the California larks in these two months would probably be largely increased if nestlings had been included in the examinations. It appears that the highest percentage of animal matter is taken in June. This, however, is only 27.7 percent, not much more than half the highest monthly average for the other members of the species. This small percentage appears the more remarkable when it is stated that the birds collected in June in California were from places where insect life abounds. Some came from the salt marshes, where fly larvæ are numerous, and others from beaches where small chrysomelids are plentiful. In most localities, however, insects are scarce during the dry season, but almost everywhere there is an abundance of vegetable food accessible to the larks. All of the weeds, except the tarweeds and a few other drought-resisting species, dry up, and a litter of broken plants, which contains many seeds, covers the surface of the ground. Ants and grasshoppers are the only insects found in any numbers in these 'dry pastures.' It is therefore not surprising that vegetable food composes 91.44 percent of the diet of the California horned larks, while the larks in the remainder of the country take less than 80 percent of the same class of food. Of the vegetable matter, weed seed, which is 51.1 percent, is less than the amount of the same kind of food taken by the other horned larks. The rest of the vegetable food, 40.2 percent, is grain, including that from wild as well as from cultivated plants. Hence the most serious complaints of the grain-feeding habits of the larks come from California, and the foregoing facts partially justify them.

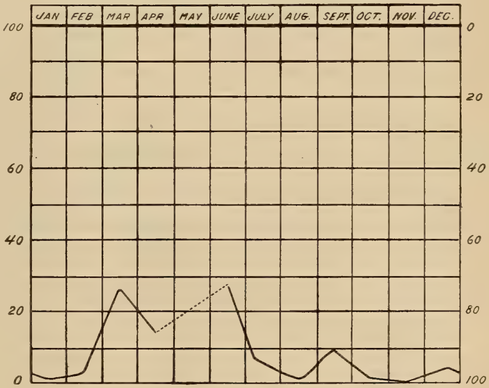

FIG. 13.—Diagram showing the proportions of animal and vegetable food of the California horned lark for every month in the year.

Of the 98 horned larks examined which had eaten wheat, 23 came from California. Two hundred and one had eaten oats, and 130 of these were from California. Of the grain eaten by the horned larks of California, 31.1 percent consists of oats and 9.1 percent of wheat, corn having been eaten by but one bird. Oats, then, are the favorite food, and on this account the horned larks are liable to damage the crop. However, a great part of the oats consumed probably comes from the wild plants so abundant in all parts of the State, and the destruction of these is a benefit.

The California horned larks consume only 8.56 percent of animal food, while the other forms collectively eat 20.61 percent. Consideration of the food habits of this subspecies indicates how powerfully local conditions, such as the abundance or scarcity of certain foods, affect the economic value of a bird. Horned larks, like other birds, naturally have recourse to the foods which are most abundant and most accessible, the ubiquitous wild oats being, in the case of the California birds, by far the greatest single element of their diet.

In California, then, where they depend chiefly upon grain for food, the horned larks may do considerable harm, especially when they are very numerous. Elsewhere in the United States, other foods being generally abundant, grain is taken only incidentally and little injury is done.

SUMMARY.

Examination of 1,154 stomachs collected in all parts of the United States and southern Canada shows that the food of the horned larks consists of insects, 20.6 percent, and vegetable matter, nearly six-sevenths of which are weed seed, 79.4 percent.

The nestlings are highly insectivorous, but soon after leaving the nest they become much more vegetarian than even the adults.

The horned larks of California differ markedly in food habits from those of other parts of the country, being almost entirely vegetarian, and although the number examined constitutes little more than a fifth of the total, yet they consume half of all the grain eaten by the whole group. Below are contrasted the amounts of grain eaten by the horned larks of California and of other States:

Grain.	California.	Elsewhere.
	Percent.	*Percent.*
Oats	31.1	4.86
Wheat	9.1	1.66
Corn	Trace.	4.97
Buckwheat	None.	.68
Total	40.2	12.2

From the above facts and figures it might appear that the California horned larks are decidedly injurious, but the quantity of oats eaten as indicated by the ratios does not fairly represent the birds' economic status, since a large proportion of this grain is wild and hence of no value to the farmer.

Of the grain eaten in the other States, buckwheat is a negligible amount, while practically all of the corn and oats eaten is waste. Although the Great Plains region, the most important wheat-growing area of the country and also the center of abundance of the horned larks, is represented by a proportionate number of the stomachs examined, yet the percentage of wheat eaten is only 1.66. In fact, the larks of this region, considered separately, are even more insectivorous than those from east of the Mississippi, one-fourth of their food being animal matter.

The charges made by farmers that the horned larks eat newly sown grain are confirmed, but in attempting to estimate the economic value of the birds it must be borne in mind that the insects they eat compensate many fold for the seed grain taken, even considered bulk for bulk. As a matter of fact, however, the insects eaten constitute almost twice as great a proportion of the food as the grain, including even that which is waste. As may be seen from the foregoing table, the grain-eating proclivities of the bird in most parts of the country result in very little damage to the farmer. Furthermore, even this small amount of injury is preventable by the use of a deep-planting drill in seeding.

It is impossible to estimate in dollars and cents the benefits resulting from the work of the horned lark, but it is none the less real on that account. Moreover, the services of the bird cost the farmer practically nothing save a small toll levied here and there upon seed grain. So small in amount is the grain thus taken and over such restricted areas that, aside from the fact that at small expense all damage can be prevented, the loss bears no comparison to the benefits conferred. The horned lark by its services to agriculture earns a right to live, and deserves protection at the hands of man.

LIST OF SEEDS, FRUITS, AND INVERTEBRATES EATEN BY THE HORNED LARKS.

GRAIN.

Corn (*Zea mays*).
Kafir corn (*Andropogon sorghum*).
Oats (*Avena sativa*).
Wheat (*Triticum sativum*).
Buckwheat (*Fagopyrum fagopyrum*).

FORAGE PLANTS.

Paspalum (*Paspalum* spp.).
Hungarian grass (*Chætochloa italica*).
Timothy (*Phleum pratense*).
Red-top (*Agrostis alba*).
Orchard grass (*Dactylis glomerata*).
Kentucky bluegrass (*Poa pratensis*).
Rape (*Brassica napus*).
Alfalfa (*Medicago sativa*).
Red clover (*Trifolium pratense*).
White clover (*Trifolium repens*).

WEEDS AND WILD FRUITS.

Eel grass (*Zostera marina*).
Large crab grass (*Syntherisma sanguinalis*).
Small crab grass (*Syntherisma linearis*)
Barnyard grass (*Echinochloa crus-galli*).
Witch grass (*Panicum capillare*).
Yellow foxtail (*Chætochloa glauca*).
Green foxtail (*Chætochloa viridis*).
Rough rush grass (*Sporobolus asper*).
Sheathed rush grass (*Sporobolus vaginæflorus*).
Wild oats (*Avena fatua*).
Wire grass (*Eleusine indica*).
Stink grass (*Eragrostis major*).
Club rush (*Scirpus* sp.).
Sedge (*Carex* sp.).
Rush (*Juncus* sp.).
Field sorrel (*Rumex acetosella*).
Western dock (*Rumex occidentalis*).
Curled dock (*Rumex crispus*).
Dense-flowered persicaria (*Polygonum portoricense*).
Pale persicaria (*Polygonum lapathifolium*).
Pennsylvania persicaria (*Polygonum pennsylvanicum*).
Lady's thumb (*Polygonum persicaria*).
Smartweed (*Polygonum hydropiper*).
Knotgrass (*Polygonum aviculare*).
Black bindweed (*Polygonum convolvulus*).
Climbing false buckwheat (*Polygonum scandens*).
Lamb's-quarters (*Chenopodium album*).
Saltwort (*Salsola kali*).
Rough pigweed (*Amaranthus retroflexus*).
Slender pigweed (*Amaranthus hybridus*).

WEEDS AND WILD FRUITS—continued.

Prostrate amaranth (*Amaranthus blitoides*).
Poke weed (*Phytolacca americana*).
Red maids (*Calandrinia menziesii*).
Miner's lettuce (*Montia perfoliata*).
Purslane (*Portulaca oleracea*).
Corn cockle (*Agrostemma githago*).
Wild pink (*Silene* spp.).
Chickweed (*Alsine* spp.).
Larger mouse-ear chickweed (*Cerastium vulgatum*).
Mouse-ear chickweed (*Cerastium* spp.).
Sandwort (*Arenaria* spp.).
Corn spurry (*Spergula arvensis*).
Black mustard (*Brassica nigra*).
Turnip (*Brassica campestris*).
Wild radish (*Raphanus raphanistrum*).
Cinquefoil (*Potentilla* sp.).
Wild red cherry (*Prunus pennsylvanica*).
Sensitive pea (*Cassia* sp.).
Lupine (*Lupinus* sp.).
Toothed medic (*Medicago denticulata*).
Melilot (*Melilotus* sp.).
Cutleaved cranesbill (*Geranium dissectum*).
Alfilaria (*Erodium cicutarium*).
Upright yellow wood sorrel (*Oxalis stricta*).
Milkwort (*Polygala* sp.).
Spotted spurge (*Euphorbia maculata*).
Spurge (*Euphorbia* sp.)
Supple-jack (*Berchemia scandens*).
New Jersey tea (*Ceanothus americanus*).
Mallow (*Malva alcea*).
Nuttall's dogwood (*Cornus nuttallii*).
Common milkweed (*Asclepias syriaca*).
Yellow bur-weed (*Amsinckia spectabilis*).
Hairy stickseed (*Lappula texana*).
Stickseed (*Lappula* sp.).
Corn gromwell (*Lithospermum arvense*).
Gromwell (*Lithospermum officinale*).
Hoary puccoon (*Lithospermum canescens*).
Narrow-leaved puccoon (*Lithospermum linearifolium*).
Blueweed (*Echium vulgare*).
Hoary vervain (*Verbena stricta*).
Blue curls (*Trichostema dichotomum*).
Nightshade (*Solanum* spp.).
Rough button-weed (*Diodia teres*).
Dandelion (*Taraxacum taraxacum*).
Small-flowered marsh elder (*Iva axillaris*)
Great ragweed (*Ambrosia trifida*).
Ragweed (*Ambrosia artemisiæfolia*).
Fleabane (*Erigeron* sp.).
Common sunflower (*Helianthus annuus*).

WEEDS AND WILD FRUITS—continued.

Sunflower (*Helianthus* spp.).
Tarweed (*Hemizonia fasciculata*).
Dog fennel (*Anthemis cotula*).
Common groundsel (*Senecio vulgaris*).
Common bur thistle (*Carduus lanceolatus*).
Napa thistle (*Centaurea melitensis*).

CULTIVATED FRUITS.

Blackberry (*Rubus* sp.).
Pear (*Pyrus* sp.).
Cherry (*Prunus* sp.).

BEETLES (COLEOPTERA).

Tiger beetles (*Cicindelidæ*).
Ground beetles and their larvæ (*Carabidæ: Agonoderus pallipes*).
Water scavenger beetles (*Hydrophilidæ*).
Rove beetles (*Staphylinidæ: Aleochara nitida; Xantholinus picipennis*).
Histerid beetles (*Histeridæ*).
Pill beetles (*Byrrhidæ*).
Click beetles and their larvæ, the wireworms (*Elateridæ: Drasterias* sp.; *Limonius plebejus*).
Fireflies (*Lampyridæ*).
Lamellicorn beetles and their larvæ, the white grubs (*Scarabæidæ: Onthophagus pennsylvanicus*; Dung beetles [*Aphodius fimetarius, A. ruricola*, and *A. inquinatus*]; June bugs [*Lachnosterna* sp.]; *Strigoderma arboricola*).
Long-horned beetles (*Cerambycidæ*).
Leaf beetles (*Chrysomelidæ: Donacia* sp.; *Pachybrachys* sp.; *Gastroidea* sp.; *Galerucella notata;* Greater striped flea-beetle [*Disonycha caroliniana*]; Strawberry flea-beetle [*Haltica ignita*]; *Longitarsus liveus*; Striped flea-beetle [*Phyllotreta vittata*]; *Chætocnema denticulata; C. protensa;* Pale striped flea-beetle [*Systena blanda*]; *Anomœa* sp.; *Chrysochus auratus*).
Blister beetles (*Meloidæ:* Black blister-beetle [*Epicauta pennsylvanica*]).
Scarred-snout beetles (*Otiorhynchidæ:* Imbricated-snout beetle [*Epicærus imbricatus*]; Yucca weevil [*Rhigopsis effracta*]: *Rhypodes* sp. nov.).
True snout beetles (*Curculionidæ: Sitones flavescens; Phytonomus nigrirostris; Macrops ulkei; Copturodes adspersus;* Potato stalk borer [*Trichobaris trinotata*]; *Centrinus* sp.; *Tyloderma nigrum*).
Nut weevils (*Calandridæ*).
Fungus beetles (*Anthribidæ*).

GRASSHOPPERS (ORTHOPTERA).

Locusts, and their eggs and nymphs (*Acridiidæ: Melanoplus* sp.).
Grouse locusts (*Tettix ornatus; Tettix* sp.).

BUTTERFLIES AND MOTHS (LEPIDOPTERA), INCLUDING CATERPILLARS, CHRYSALIDS, AND COCOONS.

Measuring worms (*Geometridæ*).
Leaf miners (*Tineidæ*).

BUGS (HEMIPTERA), INCLUDING EGGS AND NYMPHS.

Thread-legged bugs (*Emesidæ*).
Damsel bugs (*Nabidæ: Nabis ferus*).
Assassin bugs (*Reduviidæ*).
Leaf bugs (*Capsidæ:* Tarnished plant bug [*Lygus pratensis*]).
Chinch bugs (*Lygæidæ:* Chinch bug [*Blissus leucopterus*]).
Squash bugs (*Coreidæ*).
Stink bugs (*Pentatomidæ:* Green tree bug [*Nezara hilaris*]).
Burrower bugs (*Cydnidæ*).
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Spittle insects (*Cercopidæ*).
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Jumping plant lice (*Psyllidæ*).

ANTS AND WASPS (HYMENOPTERA).

Parasitic group: Ichneumon flies (*Ichneumonidæ*).
Nonparasitic group:
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  Ants (Formicina: *Formicidæ, Myrmicidæ*).

SPIDERS (ARANEIDA), INCLUDING EGGS AND EGG SACS.

Running spiders (*Lycosidæ*).
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Muscidæ: House fly (*Musca domestica*).

WHITE ANTS (ISOPTERA).

Termes sp.

ANT-LIONS (NEUROPTERA).

Myrmeleon sp.

Among the other animal matter were the following:

Centipedes (*Chilopoda*).
Millipeds (*Diplopoda*).
Mites (*Acarida*).
Snails and periwinkles (*Gastropoda: Bittium nigrum* and *B. greenii*).
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U. S. DEPARTMENT OF AGRICULTURE
BIOLOGICAL SURVEY—BULLETIN No. 24
C. HART MERRIAM, *Chief*

THE GROUSE AND WILD TURKEYS OF THE UNITED STATES, AND THEIR ECONOMIC VALUE

BY

SYLVESTER D. JUDD
ASSISTANT, BIOLOGICAL SURVEY

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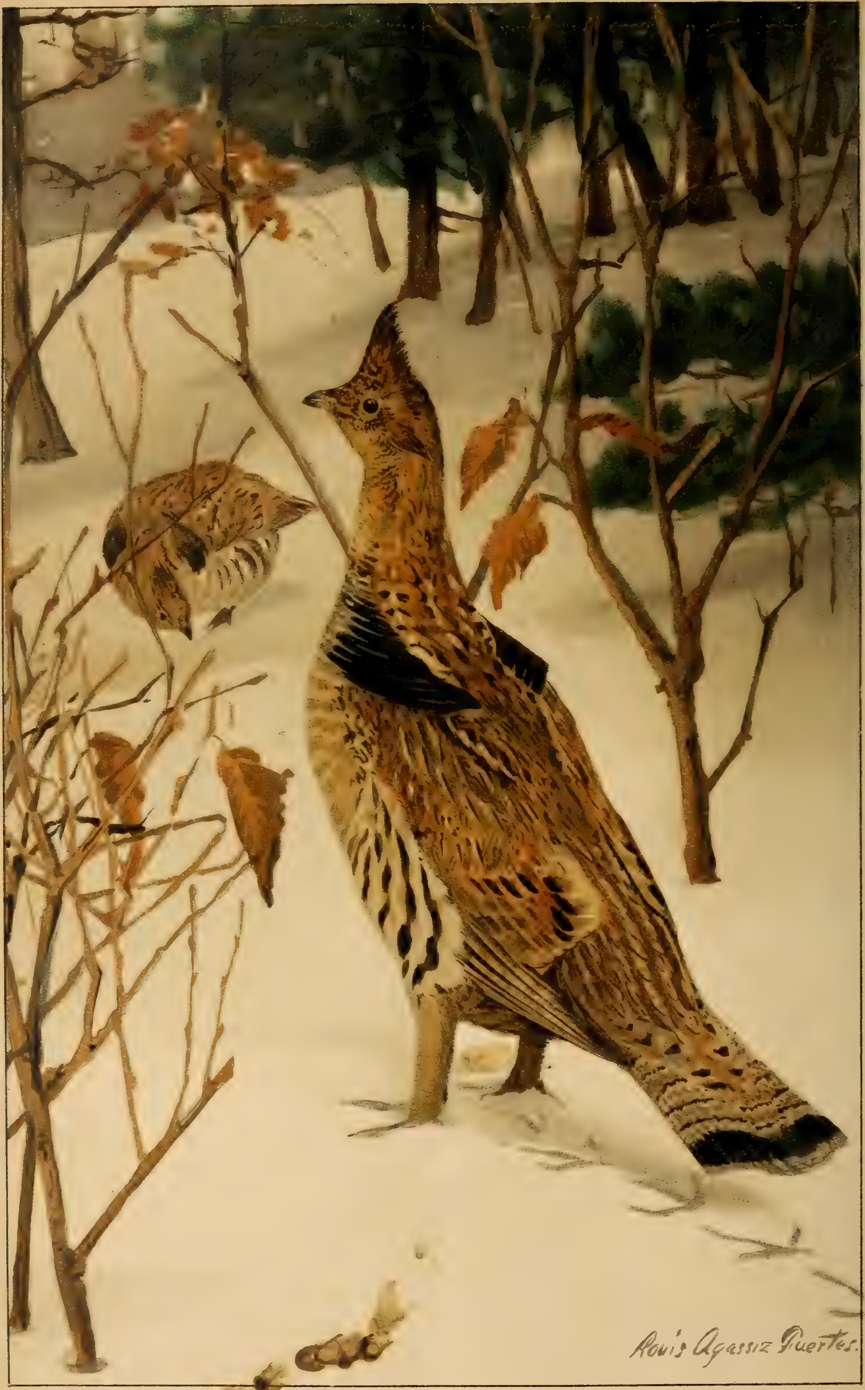
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RUFFED GROUSE (BONASA UMBELLUS).

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., July 15, 1905.

Sir: I have the honor to transmit for publication as Bulletin 24 of the Biological Survey a report on the Grouse and Wild Turkeys of the United States, by Sylvester D. Judd. From the earliest settlement of the country to the present time these game birds have been of great economic consequence. Their value as food was early recognized, and they played an important rôle by furnishing the pioneers with no small part of their fare. When found by the Spaniards domesticated among the Indians of Mexico, the importance of the turkey was at once perceived, and the bird was soon carried all over the world. It is only in comparatively recent times, however, that the economic value of grouse and turkeys as insect destroyers has been recognized. The results of the present investigations should lead to a wider knowledge of the essential part these birds play in checking the increase of noxious weeds and insects and the importance of preserving them and of increasing their numbers.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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GROUSE AND WILD TURKEYS OF THE UNITED STATES, AND THEIR ECONOMIC VALUE.

INTRODUCTION.

From the early settlement of America until the present day the size, toothsome qualities, and handsome appearance of the grouse and wild turkeys have given them a place among the most widely known and appreciated of our native birds. Throughout the conquest of the continent they served to eke out the scanty larder of the pioneer, and under the changed conditions of more recent times have taken an established place among the most prized luxuries of the table. Their habits are interesting alike to the country boy and the city sportsman, and both share in the keen pleasure of their pursuit. Their presence on the farm or in woodland is directly beneficial, owing to their destruction of harmful insects.

Twelve species of grouse occur within the limits of the United States, including Alaska. They inhabit the most varied country, from the rich prairies of the Mississippi Valley, through the heavily forested areas of the Eastern and Northern States, to above timber line on the desolate summits of mountain ranges and over dreary wastes of arctic tundra. While less beautifully marked than some of the quails, all the grouse are adorned with pleasing colors, and the males of the two species, the prairie hen and ruffed grouse, wear curiously shaped ornamental tufts of feathers on the sides of the neck. Some species have sacs on the neck, which they inflate to make the love notes more sonorous. The males of several species have over the eyes fleshy combs that are concealed by the feathers except in the mating season, when they become brightly colored and are erected to form conspicuous and attractive ornaments. These combs are especially noticeable in both the dusky grouse and the ptarmigans.

The grouse may be arranged in three groups according to the kind of country they occupy. The group of the open plains or of regions covered with a growth of scrubby bushes includes the prairie hens of the western prairies, from Manitoba south to Texas and Louisiana; the lesser prairie hen of the Southwest; the heath hen, once of the Eastern States, from Massachusetts to Virginia, now limited to Marthas Vineyard; the sharp-tailed grouse of the Northwest; and the sage cock of the sagebrush deserts of the Great Basin, a fine bird, nearly as large as a turkey.

Next are the species of the forested regions. The most notable of these, the well-known ruffed grouse, occurs in wooded areas all through the eastern and northern parts of the country from Maine to northern California, and north to Alaska. Within this wide range it varies sufficiently in color to be separable into four forms. The Canada grouse, which also has been separated into several local forms, has nearly the same range in the north as the ruffed grouse, but does not extend so far south. The Franklin grouse, closely related to the spruce grouse, occurs only from the Rocky Mountains west, and north to Alaska. The blue, or dusky, grouse, called ‘ fool-hen ’ in the Rocky Mountains, also varies in color in parts of its range so that it has been divided into several not strikingly different local forms. It is the largest of the forest-loving species and is found only in the wooded mountain areas of the West, from the Rocky Mountains and Sierra Nevada north to Alaska. The forest-inhabiting grouse are rarely near neighbors of man, and hence are of less consequence to agriculture than those of the open country.

The last group of grouse comprises the ptarmigans, which live above timber line on the high summits of the Rocky Mountains and thence north over suitable country to the arctic tundras of Alaska. The ptarmigans are remarkable for the way in which they meet the seasonal conditions of their arctic home by changing the grays and browns of their summer dress for the snowy-white of their winter one. The willow grouse, or common white ptarmigan, a circumpolar bird, is common on the tundras of Alaska and British America. With it occurs the rock ptarmigan, which is rather more of a hill bird, and which is represented on the Aleutian chain by four island forms that differ slightly in color from it and from one another. The white-tailed ptarmigan occurs above timber line in the Rocky Mountains from the northern part of New Mexico to British Columbia and Alaska. Owing to their arctic or subarctic homes the ptarmigans have practically no relations with agriculture. They are resident throughout the year and abound in many parts of Alaska, where they have long been prized as food by the natives, and now are a welcome addition to the fare of the more recent population, though, as a rule, their flesh is dry and without much flavor.

The common tame turkey is a descendant of birds taken to Europe from Mexico by the Spaniards early in the sixteenth century. The wild turkeys of the United States originally occupied a large area extending from the coast of Massachusetts west to Colorado and south to Florida and the Mexican border. While they are of the same species as the Mexican bird, they have been modified by the varying conditions of their environment into four forms, distinguished by differences in color. The best known of these is the common wild turkey of the Mississippi Valley and the Eastern States. The others are the Florida wild turkey, the Rio Grande turkey, and the Merriam turkey of the southern Rocky Mountains from Colorado south through New Mexico and Arizona. These birds differ in color to a certain extent, but have a close general resemblance. Owing to their size and the value set on their flesh, wild turkeys have been hunted so persistently that they have been exterminated over much of their former range and have become the shyest of our game birds. There are remarkable exceptions to this rule, however, as their persistence up to the present day in parts of Virginia and Maryland, within a few miles of Washington City. This ability to maintain a foothold in long-settled parts of their old territory suggests the feasibility of restocking parts of their former range. In pioneer days they were often destructive to cornfields, and in remote places they still raid grainfields, but the damage is insignificant.

Unfortunately a number of our game birds are now gone or are fast disappearing from their former haunts. An awakening appreciation of the real value of some of the species and of the evident danger of their extermination is evinced by protective laws that have been enacted in recent years throughout the country. These laws are mainly the outcome of a realization of the value of the birds from the sportsman's point of view. The investigations upon which the present report is based show that the farmer has a vastly greater interest at stake in the increase and protection of some of these birds, notably the bobwhite, than has the sportsman. In view of the decrease of both bobwhites and prairie hens it is important to know that there is every probability that proper efforts to rear these birds for restocking purposes will be successful. The numbers of bobwhite may be readily increased by careful protection, but the heath hen is already extinct in the Eastern States, and the prairie hen is nearly or quite gone from large areas in the West where it was numerous a few years ago. The restocking of suitable places in the former range of the prairie hen and even in the former range of the heath hen in the coast region of Virginia and Maryland appears to be quite practicable. The significance of an experiment made by Audubon many years ago at Henderson, Ky., is of special interest in this connection. In the fall he secured 60 prairie hens and, clipping their wings, turned them loose in his garden and orchard which contained about 4 acres. The birds quickly became tame and "walked about the garden like so many tame fowls, mingling occasionally with the domestic poultry." The importance of the prairie hen as a destroyer of weeds and insects has been demonstrated, and its value as a food and game bird is well known. As the bird possesses such good qualities and as proper efforts for its reintroduction into parts of its former range will almost certainly be successful, it is hoped that the undertaking will not long be delayed. It is unquestionable that the presence of this bird will add appreciably to the value of any farm.

THE PRAIRIE HEN.

(*Tympanuchus americanus.*)

The prairie hen, or 'prairie chicken,' inhabits the western prairies from Manitoba to southern Texas and Louisiana and from Ohio to Nebraska. The birds of southern Texas and Louisiana [a] are smaller and darker than the common bird. This big grouse, resembling a brownish-gray hen, adds animation to the western prairies and is as characteristic of them as the mockingbird is of the South. In the nuptial season the birds assemble every morning at daybreak on little hillocks on the plains, and the cocks strut about with wings drooping, tail spread, and the large orange-colored sacs on the sides of the neck fully inflated. At intervals they lower their heads and emit a singular booming love note that can be heard more than a mile, and is one of the most striking bird notes in the general spring chorus. The rivalry of the males at these gatherings often leads to fierce fights. Finally all find partners, separate into pairs, and make nests in grass-lined depressions among standing grass or similar shelter, where about a dozen eggs are laid to a clutch. Generally only one brood is raised in a season. The young, like those of other gallinaceous birds, leave the nest as soon as they are hatched and run about with the hen in search of food. In summer prairie hens roost on the ground in a family covey, as does the bobwhite, but in winter, in many sections, they roost in trees. In the fall several coveys congregate in a pack, after the fashion of ptarmigans and crested quail. Prof. F. E. L. Beal informs the writer that at Ames, Iowa, during the early eighties, he frequently found packs numbering as many as a thousand birds, and that they habitually roosted in the long grass beside sloughs. The prairie hen is migratory in the northern part of its range, and to a certain extent farther south also. The well-known authority on migration, Prof. W. W. Cooke, says: [b]

> In November and December large flocks of prairie chickens come from northern Iowa and southern Minnesota to settle for the winter in northern Missouri and southern Iowa. This migration varies in bulk with the severity of the winter.

From a gastronomic point of view the prairie hen deserves high praise; it is larger than the ruffed grouse, sometimes weighing 3 pounds, and has a delicious flavor. The flesh of young birds is light-colored, of old ones dark. The estimation in which the bird is held may be realized from the fact that in 1902 the supply at from $3 to $5 a brace nowhere met the demand. Years ago prairie chickens were shipped east by carloads, but to-day scarcity of birds and a commendable stringency of laws practically preclude shipments.

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[a] *Tympanuchus americanus attwateri* (Bendire).

[b] Bul. 2, Div. Econ. Ornith., Dept. Agri., p. 105, 1888.

Many sportsmen declare that there is no better sport than ‘ chicken ’ shooting. The bird unquestionably is one of the noblest of game birds. Though in speed of flight it by no means equals the ruffed grouse or the bobwhite, it furnishes fine sport when hunted with dogs. Early in the season, in suitable cover, it lies to a dog like a stone. So reluctant occasionally is it to fly that it can hardly be put up, and Professor Cooke informs the writer that several times while hunting in northern Minnesota he saw a pointing dog jump and catch a three-fourths grown prairie hen. Late in the fall, however, when gathered in large packs, they do not lie well.

Early in the season—that is, during the last two weeks of August and the first part of September—the prairie hen affords a better test of a dog's ability to hunt fast and to range out a mile or more from the gun than does the bobwhite. It is for this reason that field trials on ‘ chickens ’ are always well patronized, and the dogs that win are highly valued. So highly esteemed is the prairie chicken as the quarry of ‘ racing ’ dogs that abundant means for the restocking of suitable places with the species is likely to be forthcoming from field-trial patrons. The ideal conditions for ‘ chicken ’ shooting are realized in a fenceless country, where it is possible for the hunter to drive, while the dogs range from a quarter of a mile to a mile away from the wagon. As soon as they point game the sportsman hurries up and shoots. The driver ‘ marks down ’ the birds that escape and perhaps fly half a mile before alighting. Then the wagon advances to where they dropped, and shooting is again in order. In some parts of the country the sport stops at 10 or 11 o'clock in the morning, because of the intense heat during the middle of the day, when the birds are resting in places difficult of access, and is not resumed before 3 or 4 o'clock in the afternoon.

PRESERVATION AND PROPAGATION.

The prairie hen deserves well of man. It is beneficial to agriculture, is one of the best table delicacies, and its booming call is the dominant spring note of the plains, as the bird is their most characteristic resident. Furthermore, the number of entries to the yearly field trials on ‘ chickens ’ speak for it as an object of sport. In view of all the good qualities of the bird, the causes of its diminished numbers should be sought, and adequate means applied to preserve it from extinction.

At the beginning of the nineteenth century the prairie hen was extremely abundant throughout Ohio and Kentucky. It is now rare in both States. A part of the ground it has lost in the East it has gained by a westward and northward movement. It has followed the grain fields of the pioneers of the plains, and with the extension of grain culture into Minnesota and Manitoba it has become plentiful there. According to Doctor Hatch, it was by no means common when the white man first came to Minnesota, and he says that in Illinois as late as 1836 a hunter was extremely lucky if he could bag a dozen in a day. Some years later, with much less effort, one could have shot 50 in a day, and there were records of 100 to a single gun.[a]

The former status of the bird in the East is well indicated by Audubon's classic observations at Henderson, Ky., in 1810. Audubon says:[b]

> In those days during the winter the Grous would enter the farm-yard and feed with the poultry, alight on the houses, or walk in the very streets of the villages. I recollect having caught several in a stable at Henderson, where they had followed some Wild Turkeys. In the course of the same winter, a friend of mine, who was fond of practicing rifle shooting, killed upwards of forty in one morning, but picked none of them up, so satiated with Grous was he, as well as every member of his family. My own servants preferred the fattest flitch of bacon to their flesh, and not unfrequently laid them aside as unfit for cooking. * * * They could not have been sold at more than one cent apiece. * * * So rare have they become in the markets of Philadelphia, New York, and Boston, that they sell at from five to ten dollars the pair.

So far as the sportsman is concerned, the prairie hen is now extinct in Kentucky, and nowhere is the royal game bird even approximately so abundant as it formerly was in that State. There is little good chicken shooting east of the Mississippi. The best now to be had is in Kansas, Nebraska, Minnesota, the Dakotas, and Manitoba. Fortunately many people are actively interested in the protection and preservation of the prairie hen and excellent laws in its behalf already exist. There is a constantly growing sentiment in favor of nonresident hunting licenses and a legal limit to the day's bag, while some States afford the bird absolute protection for a period of years,[c] and their example should be followed wherever it is growing scarce. The passage of nonexport laws in most of the States has been productive of much good. These State laws have been made effective by a recent Federal law—the Lacey Act—which prohibits interstate commerce in game killed in violation of local laws. Through its operation the sale of the prairie hen was virtually stopped in 1902 and 1903 in all the large cities of the East. Absolute enforcement of this law and successful prohibition of local sales must be effected before the safety of the bird is assured. The laws relating to the close season have been greatly improved, but in some States the open season (four months in Oklahoma and South Dakota) is still too long.

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[a] Birds of Minnesota, p. 163, 1892.

[b] Ornith. Biog. II, p. 491, 1835.

[c] Illinois, Louisiana, and Oregon protect prairie hens until 1909, and Michigan and the Province of Ontario until 1910.

The preservation of the prairie hen is far more difficult than that of the bobwhite. The bobwhite is more prolific and does not require so extensive a range. Moreover, it is swifter of wing and habitually dives into the woods to escape the hunter. Before the hammerless gun and the wide-ranging bird dog the grouse of the open prairie falls an easy victim. It has to contend also with the trapper, besides predatory birds, reptiles, and mammals. Its most deadly enemy, however, is the prairie fire in spring, which destroys every nest within its sweep. E. W. Nelson informs the writer that in the early seventies in northwestern Illinois the farmers in many places burned the prairies in spring after the prairie hens nested, and often gathered for household use large numbers of the eggs thus exposed. Were it possible for stockmen to burn the grass a little earlier it would result in the saving of thousands of birds.

The prairie hen has the advantage, however, of yielding more readily to domestication than the bobwhite, and strong efforts should be made to establish preserves of domesticated birds for restocking country where the species is extinct. Successful enterprises of this kind would be profitable. That such domestication is possible and even feasible, the appended quotation from Audubon implies:[a]

> The Pinnated Grous is easily tamed, and easily kept. It also breeds in confinement, and I have often felt surprised that it has not been fairly domesticated. While at Henderson, I purchased sixty alive, that were expressly caught for me within twelve miles of that village, and brought in a bag laid across the back of a horse. I cut the tips of their wings, and turned them loose in a garden and orchard about four acres in extent. Within a week they became tame enough to allow me to approach them without their being frightened. * * * In the course of the winter they became so gentle as to feed from the hand of my wife, and walked about the garden like so many tame fowls, mingling occasionally with the domestic poultry. * * * When spring returned they strutted, 'tooted,' and fought, as if in the wilds where they had received their birth. Many laid eggs, and a good number of young ones made their appearance.

There is great probability of success in the restocking of much of the former range of the prairie hen if undertaken in the proper way and properly sustained by adequate protective laws. Successful results would materially add to the assets of every farm.

FOOD HABITS.

For the purposes of this report the contents of 71 stomachs of prairie hens have been examined. Fortunately this material represents not only the shooting season, but all other months except July. Most of the stomachs came from the Dakotas, Minnesota, Iowa, Wisconsin, Nebraska, and Texas; Illinois and Ontario furnished the rest. The food consisted of 14.11 percent animal matter and 85.89 percent vegetable matter. The former was insects; the latter seeds, fruit, grain, leaves, flowers, and bud twigs.

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[a] Ornith. Biog. II, p. 495, 1835.

Insect Food.

The insect food included 12.78 percent of grasshoppers, 0.48 percent of beetles, 0.39 percent of bugs, 0.12 percent of ants and other Hymenoptera, 0.29 percent of other insects, and 0.05 percent of spiders. The ruffed grouse takes about one-sixth less and the bobwhite about one-third more of insects than the prairie hen. Although the bobwhite destroys injurious grasshoppers, the relative proportions of grasshoppers and beetles consumed by it and by the prairie hen are notably different. In the food of the bobwhite the grasshoppers are to the beetles as 3.71 to 6.92; with the prairie hen the ratio stands as 12.78 to 0.48. Indeed, grasshoppers constitute the bulk of the prairie hen's animal diet, the reason being probably that on the prairies the grasshoppers vastly outnumber all other sizable insects. For a gallinaceous bird the prairie hen is highly insectivorous from May to October, inclusive, insects constituting one-third of the fare of the specimens shot during this period. The species is particularly valuable as an enemy of the Rocky Mountain locust. During an invasion by this pest in Nebraska, 16 out of 20 grouse killed by Prof. Samuel Aughey from May to October, inclusive, had eaten 866 locusts—a creditable performance, economically rated. Some ornithologists believe that the diminution in the number of prairie hens is in a measure responsible for the ravages of certain insects. Farmers who know these facts must regret the extinction of the bird in States where it once thrived, and they may well support measures for reintroducing and protecting it.

Almost every kind of grasshopper and locust appears to be acceptable to the prairie hen. In the following list are named the species of short-horned grasshoppers identified in its food:

Opomala sp.
Mermiria alacris.
Philibostroma quadrimaculatum.
Leptysma sp.
Psolœssa sp.
Ageneotettix scudderi.
Spharagemon sp.
Schistocerca americana.
Cordillacris occipitalis.
Stenobothrus curtipennis.
Melanoplus femur-rubrum.
Melanoplus atlanis.
Melanoplus bivittatus.

The prairie hen eats also long-horned grasshoppers (*Xiphidium* sp., *Conocephalus* sp., and *Orchelimum* sp.) and crickets (*Gryllus* sp.) and tree crickets (*Œcanthus* sp.).

In its beetle diet the prairie hen makes up in variety what it lacks in quantity. Unlike our common small passerine birds, but like our other gallinaceous birds, it feeds on the harmful leaf beetles. It destroys also the potato beetle (*Leptinotarsa decemlineata*), in both adult and larval stages, and the injurious 12-spotted cucumber beetle (*Diabrotica 12-punctata*). The stomach of a bird collected by H. P. Attwater, November 7, 1893, in Aransas County, Tex., contained 16 of these latter insects. Among other leaf-eating beetles eaten may be mentioned *Chrysomela pulchra*, *Chrysomela suturalis*, *Disonycha quinquevittata*, *Monoxia puncticollis*, and *Graphops pubescens*. The injurious May beetles (*Lachnosterna* sp.) also are destroyed, as well as weevils (*Thecesternus humeralis* and other species). Like many other birds, the prairie hen is partial to ground beetles. It has been known to take such kinds as *Anisodactylus rusticus*, *Agonoderus pallipes*, *Amara* sp., and *Chlœnius* sp. It probably feeds also on the different abundant species of *Harpalus*. Ladybirds are at times destroyed, as was attested by remains of *Hippodamia convergens* contained in one stomach.

Miscellaneous insects are eaten in small numbers, but are interesting because they include a number of the worst insect foes, such as the cotton worm (*Alabama argillacea*),[a] the army worm (*Heliophila unipuncta*), several species of cutworms, the yellow bear caterpillar (*Diacrisia virginica*), cankerworms (*Geometridæ*), the Angoumois grain moth (*Sitotroga cerealella*), and the chinch bug (*Blissus leucopterus*). The bird's habits of eating chinch bugs has been reported by B. F. Gault, of Chicago, and Prof. F. M. Webster, of the Bureau of Entomology. Other bugs, including stink bugs (*Euschistus* sp.) and the tree hoppers (*Stictocephalus* sp.) make part of the food. In addition to ants, such as *Formica exsectoides*, the prairie hen occasionally eats other Hymenoptera, including *Tiphia inornata* and gall insects contained in the galls of Cynipidæ. In its liking for galls and their contents the bird resembles the ruffed grouse and the British pheasant.

Further study of the food habits of the prairie hen will unquestionably add largely to the foregoing enumeration of insects, but our present knowledge, incomplete as it is, shows the general character of its insect food, and establishes the value of the species as a destroyer of insect pests.

VEGETABLE FOOD.

From October to April, inclusive, the prairie hen takes little but vegetable food. This element amounts to 85.89 percent for the year. Fruit constitutes 11.79 percent; leaves, flowers, and shoots, 25.09 percent; seeds, 14.87 percent; grain, 31.06 percent, and miscellaneous vegetable material, 3.08 percent.

Like the bobwhite and the ruffed grouse, the prairie hen is fond of rose hips, and the abundant roses of the prairie yield 11.01 percent of its food. This fact perhaps may be a useful hint to anyone who attempts to introduce the bird or to improve its environment. The other fruit found was of little importance—merely 0.78 percent. It was made up of domestic cherries, woodbine berries, sumac, poison ivy, huckleberries, strawberries, partridge berries, mistletoe, wild grapes, the berries of *Solanum* and *Symphoricarpus*, and cornel (*Cornus asperifolia*). Of the frugivorous habits of the prairie hen Audubon writes:[a]

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[a] Fourth Rep. U. S. Ent. Commission, p. 88, 1885.

> In the western country, at the approach of winter, these birds frequent the tops of the sumach bushes, to feed on their seeds, often in such numbers that I have seen the bushes bent by their weight.

It is important to note that often when deep snow causes scarcity of other supplies the sumac affords both the prairie hen and the bobwhite abundant food. As with the insect food, further investigation undoubtedly will extend the fruit list.

The prairie hen eats a much smaller proportion of seeds, with the exception of grain, than the bobwhite, and in this respect is less useful than the latter bird. It is, however, a better weeder than any other grouse, and its services in this particular are worthy of consideration. As before stated, seeds make 14.87 percent of the annual diet. Of these, grass seeds form 1.03 percent; seeds of various polygonums, 8.49 percent, and miscellaneous weed seeds, 5.35 percent. When the nature of the prairie hen's habitat is recalled it seems strange that the percentage of grass seed is so small. The bobwhite, in contrast, takes 9.46 percent of grass seed. Like the bobwhite and other granivorous birds, the prairie hen often eats the seeds of the various species of panicums, the paspalums, and pigeon grass (*Chætochloa viridis*).

The seeds of different polygonums, or smartweeds, play an important part in the economy of the prairie hen. They form 8.49 percent of the food. These plants grow profusely where illy drained regions of the plains are under water for a few months in the year. Black bindweed (*Polygonum convolvulus*) and smartweed (*Polygonum lapathifolium*), with the closely related dock (*Rumex crispus*), are included in the bill of fare. Of the 5.35 percent of remaining miscellaneous seeds, ragweed (*Ambrosia artemisiæfolia*) is the most important element, but is insignificant in amount when compared with the same element of the bobwhite's food. Other compositæ are eaten by the prairie hen—wild sunflower, coreopsis (*Coreopsis cardaminefolia*), and others. The prairie hen has a liking for legumes, reminding one again of the bobwhite. It selects two of the latter's favorites—cassia, and the hog peanut (*Falcata comosa*). It takes also the seeds of a closely related plant, the prairie mimosa (*Acuan*). It has been known to feed on seeds of water willow (*Dianthera* sp.), the yellow false garlic (*Nothoscordum bivale*), blue-eyed grass (*Sisyrinchium graminoides*), shepherd's purse (*Bursa bursa-pastoris*), mercury seeds (*Acalypha* sp.), croton seeds (*Croton* sp.), and seeds of purslane (*Portulaca oleracea*), the seeded pods of the latter being plucked.

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[a] Ornith. Biog., II, p. 501, 1835.

GRAIN.

As a grain eater the prairie hen heads the native gallinaceous birds. Everybody who has gone 'chicken' shooting knows how closely the bird is associated with stubble fields. The stomachs and crops examined in the investigation contained 31.06 percent of grain. The bobwhite, another busy stubble feeder, takes only 17.38 percent. The stomach of a grouse shot in June in Nebraska contained 100 kernels of corn and 500 grains of wheat. J. A. Loring, formerly of the Biological Survey, during December in Nebraska found prairie hens feeding in wheat stubble, about straw stacks, and along the edges of cornfields. Doctor Hatch, in writing of their granivorous habits, says:[a]

> The grain fields afforded both food and protection for them, until the farmers complained of them bitterly, but not half so bitterly as they did afterwards of the bird destroyers who ran over their broad acres of wheat, oats, and corn in the order of their ripening.

Buckwheat, barley, oats, and millet are relished, but corn appears to be the favorite cereal, amounting to 19.45 percent of the annual food. Other grain, principally wheat, was in the ratio of 11.61 percent. Amos W. Butler reports that in Indiana, during September, fields of ripening buckwheat are favorite feeding grounds.[b] There is reason to believe that sprouting grain is sometimes injured. Audubon speaks of such injury in Kentucky, where the bird was extremely abundant.[c]

Like other gallinaceous birds, the prairie hen likes mast, though naturally it obtains much less than the ruffed grouse. The stomach contents showed the beaked hazelnut (*Corylus rostrata*) and acorns, including, among others, those of the scrub oak (*Quercus nana*) and the scarlet oak (*Q. coccinea*). Like the ruffed grouse, it swallows acorns whole. A bird shot in Minnesota in March had bolted 28 scarlet-oak acorns.

LEAVES, FLOWERS, AND SHOOTS.

Like other grouse the prairie hen is an habitual browser, to the extent of 25.09 percent of its food. This is divided as follows: Twigs or shoots, 0.55 percent; flowers, 9.34 percent, and leaves, 15.20 percent. This is only half the amount of similar food taken by the ruffed grouse. Naturally the prairie hen is much less given to budding than the ruffed grouse, but it has been known to pluck buds of poplar, elm, pine, apple, dwarf birch (*Betula glandulosa*), and black birch (*B. lenta*). "I have counted more than 50 on a single apple tree," writes Audubon,[a] "the buds of which they entirely destroyed in a few hours. * * * They were, in fact, looked upon with more abhorrence than the crows are at present in Massachusetts and Maine, on account of the mischief they committed among the fruit trees of the orchards during winter, when they fed on their buds, or while in the spring months, they picked up the grain in the fields." This mischief was due largely to the abundance of the birds, a condition never likely to return.

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[a] Birds of Minnesota, p. 163, 1892.

[b] Ann. Rept. Dept. Geol. Ind., 1897, p. 758.

[c] Ornith. Biog., II, p. 491, 1835.

The prairie hen shows a marked taste for flowers. A delicate pink rosebud had been plucked by a bird shot at Omega, Nebr., in June. More than a thousand golden-rod heads were found in another. Additional composite flowers devoured were Amphiachyris (*Amphiachyris dracunculoides*), sweet balsam (*Gnaphalium obtusifolium*), and others. The flower and leaf buds of birch and apple also are taken. Small green ovaries of *Ruellia* and blue-eyed grass were noted in a few cases. These birds eat leaves, including those of the buttercup, everlasting (*Antennaria*), red and white clover, and the interesting water milfoil (*Myriophyllum*), often grown in goldfish globes.

Food of the Young.

The economic value of the prairie hen is due mainly to its destruction of weeds and harmful insects, the latter constituting almost the sole food of the downy chick. Unfortunately only two stomachs of young birds were to be had for examination. The chicks were recently hatched Texas prairie hens (*Tympanuchus americanus attwateri*). They had eaten 1 tree cricket, 5 undetermined caterpillars, 1 imago of the very destructive Angoumois grain moth, 1 leaf beetle (*Monoxia puncticollis*), and 19 12-spotted cucumber beetles (*Diabrotica 12-punctata*), which do not always confine themselves to cucumbers, but injure more than a dozen other cultivated plants.

THE HEATH HEN.

(*Tympanuchus cupido.*)

The heath hen, which, to casual view, appears like a small-sized prairie hen, inhabits the scrub oaks of the island of Marthas Vineyard, on the coast of Massachusetts. It was formerly abundant in

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[a] Ornith. Biog., II, pp. 491 and 501, 1835.

Connecticut and the eastern parts of New York, New Jersey, Pennsylvania, and Virginia.

As no stomachs of this now rare bird were to be had for examination, we must depend on the work of other investigators for knowledge of its food habits. Audubon[a] quotes David Eckley as follows:

> The bayberry, which abounds in many parts of Martha's Vineyard, is the principal food of the Grous particularly such as grows on low bushes near the ground, and is easily reached by the birds. They also feed on the boxberry, or partridge berry, the highland and lowland cranberry, rosebuds, pine and alder buds, acorns, etc.

William Brewster in 1890 ascertained that, all told, there were probably only about 200 heath hens, and that they were confined to about 40 square miles of the island of Marthas Vineyard. In speaking of their habits, he says:[b]

> At all seasons the heath hens live almost exclusively in the oak woods, where the acorns furnish them abundant food, although, like our ruffed grouse, they occasionally, at early morning and just after sunset, venture out a little way in the open to pick up scattered grains of corn or to pluck a few clover leaves, of which they are extremely fond. They also wander to some extent over the scrub-oak plains, especially when blueberries are ripe and abundant. In winter, during long-continued snows, they sometimes approach buildings to feed upon the grain which the farmers throw out to them.

If this bird can be saved from extinction and introduced into many of the Eastern States, it will be much more likely to succeed, on account of its woodland habits and narrow range, than the prairie hen, which requires a more open country and usually does not take refuge in woods from its enemies. Experiments with the heath hen must be made soon, however, or it is likely to become extinct.

THE LESSER PRAIRIE HEN.

(*Tympanuchus pallidicinctus.*)

The lesser prairie hen is a smaller bird than the common species of the Mississippi Valley and is found from western Texas north to western Kansas. But little of its life history is known. It has been found breeding abundantly the first of June at Fort Cobb, Ind. T., and William Lloyd observed this grouse wintering in Concho and Tom Green counties, Tex. H. C. Oberholser, of the Biological Survey, found them common in August, 1901, in Wheeler County, Tex., where they frequented rolling plains overgrown with oak brush from 1 to 4 feet high. These oaks are evergreen, and the prairie hen feeds upon the buds and young shoots. At the time of Oberholser's visit the birds were in coveys of from

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[a] Ornith. Biog., II, p. 500, 1835.

[b] Forest and Stream, XXXV, p. 188, 1890.

15 to 20, but, according to the people of that section, the prairie hens gather in flocks of hundreds in the late fall. At this season they are destructive to unthreshed wheat and oats, tearing off the surface of the stacks. In winter they visit cattle pens and corrals in search of food. During severe winters they are sometimes so numerous that they become a nuisance. Some idea may be had of their abundance during winter from the information secured by Oberholser that one man shipped 20,000 of them from this section in a single season.

THE SHARP-TAILED GROUSE.

(*Pediœcetes phasianellus.*)[a]

The sharp-tailed grouse is about the same size and has the general appearance of the prairie hen. Its range is wide, extending from Lake Michigan to northeastern California, and from northeastern New Mexico to Alaska. In the northern part of the Mississippi Valley its range overlaps that of the prairie hen, and mixed flocks are sometimes seen, but the 'spike tail' is seldom found in such large numbers as that species. It shows also much less adaptability to changed conditions and disappears more rapidly after the subjection of its range to agriculture. In regard to its curious courtship, Professor Macoun writes of the Columbian sharp-tailed grouse:[b]

> The males collect in large numbers on some hill about the end of April or beginning of May to have their annual dance, which they keep up for a month or six weeks. It is almost impossible to drive them away from one of their hills when they are dancing. One day about the middle of May, I shot into a dancing party, killing two, and wounding another, which flew a short distance. I went to get it, and before I got back to pick up the dead birds, the others were back dancing around them.

About a dozen eggs generally make a clutch, and but one brood is reared in a season. The eggs vary from buff to olive-brown and are usually lightly spotted with brown.

From two to three months after hatching, the young are full grown and afford quite as good if not better sport than the prairie hen. They lie well to the dog and usually rise with a noisy, clucking cry; after a short distance the flight changes to an alternation of rapid vibrations of the wings and gliding or sailing on stiffly outspread pinions. The flesh of the young, like that of young prairie hens, is light colored and deliciously flavored. After the birds begin to pack they afford little sport to the hunter.

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[a] The sharp-tailed grouse varies in different parts of its range, and has been divided into two geographic forms in addition to the typical bird. These are the Columbian sharp-tailed grouse (*Pediœcetes phasianellus columbianus*), occupying the western part of the bird's range in the United States, and the prairie sharp-tailed grouse (*Pediœcetes phasianellus campestris*) which covers the plains east of the Rocky Mountains.

[b] Cat. Can. Birds, pt. 1, p. 212, 1900.

The sharp-tailed grouse are partly migratory. In winter they take refuge in the highest trees, walking among the branches almost as nimbly as the ruffed grouse. Like the latter, the present species has a habit of plunging into the snow to spend the wintry night. It has many natural enemies in the winter, and in summer the golden eagle has been known to feed its young very largely upon its flesh. Its struggle for existence is unusually severe. Wherever it abounds, in accessible districts, it is pursued relentlessly by the sportsman; but where diminished to a certain point, as on its western and northern ranges, hunting it is largely abandoned. Probably some decades will pass, therefore, before it will be in danger of total extinction. As it does not readily accept civilization, it is not likely to become a popular bird in our growing game preserves, which each year become of greater economic importance.

FOOD HABITS.

The food habits of the sharp-tailed grouse have been studied in connection with the present paper by the examination of 43 stomachs. These were collected in every month of the year except January and March; most of them in Nebraska and the Northwest Territories, but some in Minnesota, North Dakota, and Manitoba. The investigations showed that animal matter (insects) formed only 10.19 per cent of the food, while vegetable matter (seeds, fruit, and 'browse') made 89.81 percent. If subsequent study proves that these figures apply generally to the species, the sharp-tailed grouse is to be classed among the birds most largely vegetarian.

INSECT FOOD.

The insect matter consists of bugs, 0.50 percent; grasshoppers, 4.62 percent; beetles, 2.86 percent, and miscellaneous insects, 2.21 percent in a total of 10.19 percent of the food. Vernon Bailey, of the Biological Survey, found that three birds shot by him in Idaho August 29 had eaten chiefly insects, including grasshoppers, small bugs, and small caterpillars. Baird, Brewer, and Ridgway state that the Columbian sharp-tailed grouse has been known to feed on caterpillars and other insects that have been scorched by prairie fires.[a]

The young of the sharp-tailed grouse, like those of other gallinaceous species, are highly insectivorous. A downy chick from 1 to 3 days old, collected on June 27, in Manitoba, by Ernest Thompson Seton, had eaten 95 percent of insects and 5 percent of wild strawberries. The insect material consisted of a lepidopterous chrysalis and the remains of beetles and black ants (*Camponotus pennsylvanicus*). Another young bird, about 8 days old, taken by the same collector, had been exclusively insectivorous. It had eaten such beetles as weevils, ground beetles (*Harpalus herbivagus*), the ladybird (*Anisosticta seriata*), and the click beetle (*Dolopius lateralis*), also 2 cutworms, 9 sawfly larvæ, such leaf hoppers as *Tettegonia* sp. and *Helochara communis*, and 1 leaf spider. The sharp-tailed grouse is fond of grasshoppers. Vernon Bailey shot 3 birds at Elk River, Minn., September 17, 1894, which had eaten, respectively, 7, 23, and 31 grasshoppers. The species is a destroyer also of the Rocky Mountain locust. Of 9 birds collected by Professor Aughey from May to October, inclusive, 6 had eaten 174 of these pests.[a] The bird eats also a few crickets and, like other gallinaceous game birds, devours the Colorado potato beetle (*Leptinotarsa decemlineata*). It has been known to feed on the bugs *Oncometopia lateralis* and *Oncometopia costalis*. The lack of sufficient material to determine exactly the bird's relation to insects is to be regretted, but enough is at hand to demonstrate the fact that its insect food is much like that of its relatives.

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[a] Hist. N. A. Birds, Land Birds, III, p. 439, 1874.

VEGETABLE FOOD.

The vegetable food of the sharp-tailed grouse, so far as ascertained in the laboratory, comprises weed seeds, 7.39 percent; grain, 20.50 percent; fruit, 27.68 percent; leaves, buds, and flowers, 31.07 percent, and miscellaneous vegetable food, 3.06 percent; making a total of 89.81 percent. The weed-seed element consists of the seeds of black bindweed (*Polygonum convolvulus*) and other polygonums, wild sunflower (*Helianthus* sp.), ragweed (*Ambrosia artemisiæfolia*), peppergrass (*Lepidium*), blue-eyed grass, sedge, and catchfly (*Silene antirrhina*). The seeds of a number of leguminous plants are eaten, including those of alfalfa. Like many other game birds, the species feeds on mast (largely acorns), including acorns of the scarlet oak (*Quercus coccinea*). Corn is eaten, but wheat is the favorite grain. It formed 17.21 percent of the food. A thousand kernels of wheat were sometimes found in one stomach.

The sharp-tailed grouse is a great browser. It makes 31.07 percent of its food of leaves, buds, and flowers. Ernest Thompson Seton found it eating the buds of willow and birch. It feeds on the leaves of cottonwood, alder, blueberry, juniper, and larch; also leaves of quillwort (*Isoetes*), vetch, dandelion, grass, and rush (*Juncus*). Hearne says that in winter it eats the tops of the dwarf birch and the buds of poplars. Flowers form 19.90 percent of its diet, the species leading all other birds in this respect. A half pint of the showy, bluish blossoms of the pasque flower (*Pulsatilla hirsutissima*) which brightens the western prairie are often taken at a meal, and those of the dandelion also are eaten. Inflorescence of grasses, alder, willow, maple, and canoe birch are plucked along with leaf buds.

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[a] First Rep. U. S. Entom. Comm., Append. II, p. 47, 1877 (1878).

Like the prairie hen and the ruffed grouse, the sharp-tailed grouse is frugivorous, and fruit forms 27.68 percent of its diet. Hips of wild rose alone form 17.38 percent. Ernest Thompson Seton, who examined hundreds of stomachs of the sharp-tailed grouse, says that he can not recollect an instance in which they did not contain the stony seeds of the wild rose (*Rosa blanda* [?]).[a] The Biological Survey has found rose seeds in many of the stomachs examined, but in numerous instances it has recorded their absence. The fruit of both prairie rose and the sweetbrier (*Rosa rubiginosa*) are eaten. Mr. Seton states that in places in Manitoba where he has collected during the winter, gravel to pulverize the food is not to be had, and the stony rose seeds act in its stead. Rose hips appear difficult to digest, and, furthermore, are sometimes thickly set with bristles that would irritate the human stomach, but appear to cause no inconvenience to the grouse. The persistent bright-colored hips are readily seen above the snow, and they are a boon to the birds in wintry northern regions, where the struggle for existence is bitter. Other plants of the rose family furnish food for the sharp-tailed grouse, such as the thorn apple (*Cratægus* sp.), the wild strawberry, and the wild black cherry (*Prunus serotina*). It feeds on blueberries and cranberries and on the snowberry (*Symphoricarpus racemosus*), various species of manzanita, bearberry (*Arctostaphylos uva-ursi*), buffalo berry (*Lepargyrea argentea*), juniper berries, huckleberries, and arbutus berries. It takes also the partridge berry (*Mitchella repens*), a favorite with the ruffed grouse. Like many other species, it eats with relish the fruit of cornel (*Cornus stolonifera*) and poison ivy (both *Rhus radicans* and *Rhus diversiloba*).

THE SAGE GROUSE.

(*Centrocercus urophasianus.*)

With the exception of the wild turkey, the sage grouse is our largest game fowl. It is a fine-looking bird, with gray back, black breast, and long tail, and attains a maximum weight of 8 pounds. It breeds on the sagebrush plains of the Upper Sonoran and Transition zones, from the east slope of the Sierra Nevada and Cascade mountains in Nevada, California, and British Columbia, east to Assiniboia, Dakota, Nebraska, and Colorado. At mating time the cock inflates the sacs on the sides of his neck until they look like small oranges, and then goes through a droll performance, throwing himself forward on his breast and plowing along the ground until the breast feathers are almost completely worn away. The hen is captivated by these grotesque antics, and in due time chooses a mate and nests in a small depression in the ground under the shelter of a bush, where she lays about ten olive-buff eggs with chocolate markings. The cock leaves her before incubation begins, and in about three weeks the chicks are out. A young covey roosts in a circle on the ground, bobwhite-fashion. In winter, coveys unite in packs which sometimes number a hundred or more.

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[a] Proc. U. S. Nat. Mus. XIII, p. 519, 1890 (1891).

FOOD HABITS.

The feeding habits of the sage grouse are peculiar, and its organs of digestion are unlike those of other grouse. The stomach is not differentiated into a powerful grinding gizzard, but is a thin, weak, membranous bag, resembling the stomach of a raptorial bird. Such an organ is evidently designed for the digestion of soft food, and we find that the bulk of the sage grouse's diet consists of leaves and tender shoots. A stomach collected September 7, 1890, in Idaho, by Dr. C. Hart Merriam, contained leaves of sage and other plants, seeds, and a ladybird beetle (*Coccinellidæ*). Four birds shot in Wyoming during May and September by Vernon Bailey had gorged themselves with the leaves of sagebrush (*Artemisia tridentata*). This and other sages, including *A. cana* and *A. frigida*, furnish the bulk of the food of the sage grouse. Other food is taken, but it is comparatively insignificant. B. H. Dutcher, formerly of the Biological Survey, examined a stomach which, besides sagebrush leaves, contained seeds, flowers, buds of *Rhus trilobata*, and ants and grasshoppers. Three birds collected by Vernon Bailey on September 5, in Wyoming, had varied their sagebrush fare with ladybird beetles, ground beetles (*Carabidæ*), fly larvæ, ants, moths, grasshoppers (*Melanoplus* sp.), and the leaves of asters and yarrow. Of two birds killed in May, one had fed wholly on the leaves of sagebrush (*Artemisia tridentata*), while the other in addition had taken insect galls from sagebrush and the flowers and flower buds of a phlox (*Phlox douglasii*), together with some undetermined seed capsules, pieces of moss, and several ants. A third bird, killed in July, had eaten a few plant stems and numerous grasshoppers.

Major Bendire writes that the diet of the sage grouse includes grass spikes, the tops of leguminous plants, including blossoms and pods of vetch (*Vicia*) and astragalus; also, that the bird eats goldenrod, and will go far to get a morning feed of wheat. He notes that also berries, grasshoppers, and crickets (*Anabrus simplex*) are eaten.[a]

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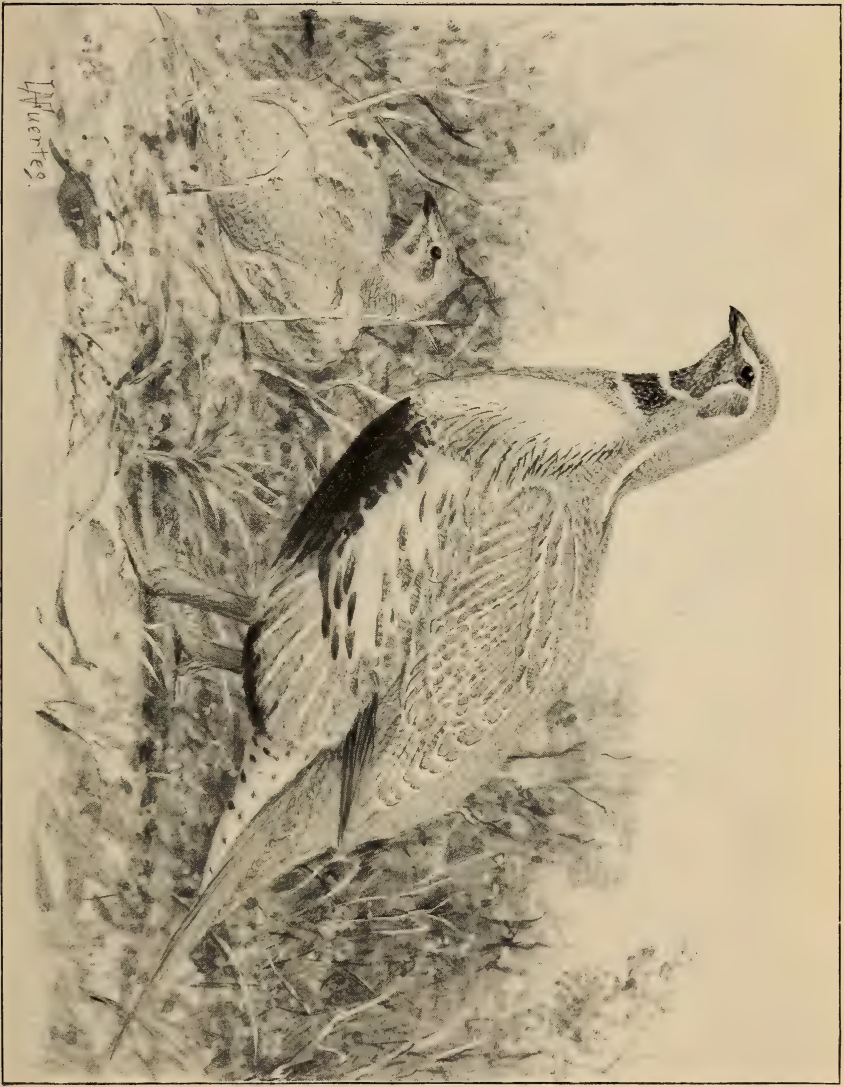
[a] Life Hist. N. A. Birds, [I], pp. 107–108, 1892.

PLATE II.



SAGE GROUSE (CENTROCERCUS UROPHASIANUS).

Sage grouse have been known to eat rose hips, greasewood leaves, and the buds and foliage of the pulpy-leaved thorn.[a]

The young, of course, are more highly insectivorous than their parents. A half-grown bird shot by Vernon Bailey had eaten, in addition to vegetable food, some 300 ants.

Much remains to be learned about the diet of the sage grouse, but enough is known to show that the bird lives principally on sagebrush, and does no harm to agriculture. The value of the flesh as food has been much discussed, but the general opinion is that when the birds have not been feeding much upon sage the flesh is excellent. A long-continued diet of sagebrush imparts to it a bitter, sagy flavor. Hon. Theodore Roosevelt says:[b]

> However, I killed plenty of prairie chickens and sage hens for the pot, and as the sage hens were still feeding largely upon crickets and grasshoppers, and not exclusively on sage, they were just as good eating as the prairie chickens.

Sage grouse should be drawn as soon as they are killed, to prevent the food in the stomach and intestines from tainting the flesh. The sage grouse is of very gentle disposition, and probably would thrive in captivity. Should it be domesticated, its size would make it a most valuable fowl. E. S. Cameron, of Terry, Mont., writes to the Biological Survey that he has made a beginning in this direction. He secured eggs of the sage grouse, hatched them under a domestic hen, and some of the chicks survived.

THE RUFFED GROUSE.

(*Bonasa umbellus.*)[c]

The ruffed grouse is widely distributed over the wooded parts of the United States and Canada, and ranges from northern Georgia, Mississippi, and Arkansas north to Hudson Bay and central Alaska, and from Maine to the coast of Oregon. The different conditions of environment prevailing over this great range have had their effect in modifying the colors of the ruffed grouse so that several forms may be distinguished. The color differences between the bird of the southern Rocky Mountains and the Oregon ruffed grouse of the humid west coast are especially marked. The latter is the most richly colored of the North American grouse, and is notable for its handsomely contrasted black and reddish brown colors, set off by immaculate white.

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[a] Wilson and Bonaparte, Am. Ornith., IV, p. 214, 1831.

[b] The Wilderness Hunter, p. 99, 1893.

[c] The ruffed grouse is separable into four forms: The common bird of the Eastern States (*Bonasa umbellus*); the Canadian ruffed grouse (*B. u. togata*) of the spruce forests along the northern border, from Maine to British Columbia; the gray ruffed grouse (*B. u. umbelloides*) of the Rocky Mountains, north to Alaska; and the Oregon ruffed grouse (*B. u. sabini*) of the humid west coast, from northern California to British Columbia.

The ruffed grouse is one of the most highly prized of American game birds. It is known in New England as the 'partridge,' but in the Southern States it is usually called 'pheasant.' It is distinctly a bird of the woods, imparting the spirit of the wilderness to every sylvan retreat that it inhabits. In Virginia and Maryland, near the city of Washington, the species is, or was until recently, not uncommon along the rocky palisades of the Potomac and in deep gorges lined with laurel thickets. In Essex County, N. J., it frequents the crest of a wooded basaltic dike known as the Orange Mountains, where the picturesque rocky woods with a good stand of deciduous trees and an undergrowth of blueberry, second-growth white oak, wild grape and bittersweet vines, and beds of partridge berry (*Mitchella repens*) furnish a congenial home. That ruffed grouse usually prefer deciduous to evergreen growths was particularly noticed by the writer in 1892 and 1898 at Chocorua, N. H., a hamlet between Lake Winnepesaukee and the White Mountains. On his tramps through heavy spruce forests remote from houses or clearings he seldom came across grouse. He frequently met them, however, in woodland near farms or in clearings, and particularly along wood roads. A favorite ground in August was the clearing of an abandoned farm, 200 feet above Chocorua Lake, which lies at the foot of Chocorua Mountain. The fields are separated from one another by little trout brooks and have grown up to young spruces. Here in bowlder-strewn pastures was an abundance of blackberries, blueberries, and grasshoppers, with old apple trees, birches, and poplars for winter budding. On this old farm the writer never failed to flush from three to eight grouse, and on several occasions he saw hen birds with young. In a sandy spot of the road leading up to the house the grouse had dusting wallows, which they used habitually. During October birds were often found in hemlock woods with an undergrowth of osmunda ferns or other vegetation.

The ruffed grouse does not congregate in large coveys, like the plumed quails or the prairie chicken, but is found in companies of from two to eight, usually members of a single brood. It does not spend the night on the ground, but perches on a tree. When the weather is very cold, however, it often plunges into the snow and passes the night as snugly as an Eskimo in his igloo.

The bobwhite whistles, the prairie chicken booms, and the blue grouse hoots, but the ruffed grouse drums. The drumming is one of the most interesting and attractive of all bird performances. It may be heard at every season, but is at its best in spring. The cock, then in full vigor, mounts his drumming log, droops his wings, raises his fantail, and struts along the log with his crest and glossy black neck tufts erect. He begins beating his wings slowly; then faster and faster, till their rapid reverberation becomes a tattoo, rolling out a challenge to rival cocks and a love call to the hens.

Nesting takes place in the latter part of April, or more often early in May. In a makeshift nest scratched in a hollow are laid ten or a dozen or even more creamy white or buffy eggs, usually unspotted, but sometimes with fine specks of brown. The young look like little brown leghorn chicks. Only one brood is raised in a season. On July 4, in New Jersey, the writer has seen young birds as large as woodcock. The cock grouse assist neither in incubation nor in rearing the young, but after the eggs are laid assemble in small companies by themselves. The hen is amply able to care for her little family, and Mr. Sandys tells how a mother forced to headlong and unvalorous flight a young pointer that had designs on her brood.[a] The notes of the grouse during the breeding season are interesting. When the brood is surprised the hen utters several clucking sounds, one of which may be described as 'quit, quit, quit.' Mr. Sandys, in writing of the call of the parent birds to scattered chicks, says:[b]

> In about ten minutes there sounded a low musical chirruping, very like the sound emitted by a red squirrel between the coughing, sputtering notes.

Major Bendire, quoting Doctor Ralph, says that a disturbed mother grouse utters a sound like the whine of a young puppy.[c]

Of the habits and general attractiveness of the ruffed grouse Major Bendire writes as follows:[d]

> The Ruffed Grouse is naturally tame and unsuspicious, and let it once realize that it is protected, it becomes almost as much at home in the immediate vicinity of man as a domestic fowl, and quickly learns to know its friends. At the fine country residence of the Hon. Clinton L. Merriam, near Locust Grove, N. Y., especially during the winter, it is not an unusual sight to see several of these handsome birds unconcernedly walking about the shrubbery surrounding his home, and even coming on the veranda of the house to feed. They, like many other animals about the place, have learned that here at least they are among friends, and plainly show their full confidence in them. Even during the mating season a cock Grouse may frequently be seen in the act of drumming within 50 yards of some of the outbuildings.

Bird Lore, for May–June, 1904, has an account of a wild hen grouse which was so tame that it would come out of the woods at call and allow itself to be picked up, thus displaying the most unbounded confidence in its human neighbors. To lovers of nature the æsthetic value of this beautiful bird is very great, and its value is none the less, although it can not be measured in cash.

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[a] Upland Game Birds, pp. 118–119, 1902.

[b] Ibid., p. 119, 1902.

[c] Life Hist. N. A. Birds [I], p. 62, 1892.

[d] Ibid., p. 60, 1892.

The ruffed grouse affords grand sport; indeed, with not a few sportsmen it holds higher place even than bobwhite. In flight it is one of the swiftest of upland game birds, and considerable skill, a quick eye, and a steady hand are needed to shoot it on the wing. Most shots must be made in cover, and the bird's habit of putting a tree between itself and the sportsman as it flies away adds to the difficulty. As a rule it does not lie nearly so close to a dog as bobwhite, but before a well-trained, cautious animal it lies fairly well. When brought to bag the grouse is a noble prize. From six to nine birds may be called a good day's bag, worth more than several times as many bobwhites. The excellence of this grouse as a table delicacy causes the market supply generally to fall far short of the demand, and the price is always high. If the bird could be successfully bred in captivity, it would furnish a most valuable food.

PRESERVATION AND PROPAGATION.

The ruffed grouse has a number of potent enemies. Most dangerous of all is probably that destructive biped, man. Writing from Minnesota, Dr. P. L. Hatch says:[a]

> Nowhere was the ruffed grouse more abundant than in all the deciduous forests of this State, until mercilessly slaughtered by the pot hunters. * * * But their glorious day is passing away as fast as about 300 dogs and 700 double-barreled breech-loading shotguns can accomplish their annihilation.

Many market hunters of the grouse use a little cur dog trained to tree the game and to bark until the gunner approaches within range. Of the numerous natural enemies, hawks, owls, crows, skunks, minks, wild cats, and foxes are very destructive, and in certain localities a species of tick often infests the birds. Among the birds of prey, the Cooper hawk, goshawk, red-shouldered hawk, barred owl, and great horned owl are their worst enemies. At Marshall Hall, Md., the writer found a crow plundering the nest of a grouse. Almost everybody who is personally familiar with the habits of the fox has found it feeding on game birds. At Chocorua the writer came upon the den of a red fox about which were strewn tail feathers of the ruffed grouse. Owners of shooting preserves will do well to destroy systematically all vermin injurious to game. The bird should have better protection also from man. Massachusetts still permits landowners to snare grouse on their own lands during October and November. Such destructive and unsportsmanlike practices should be prevented everywhere by well-enforced laws. The abominable practice by summer campers of potting grouse when they have young should also be punished by a strict enforcement of the law. In sections where grouse are decreasing under persistent gunning the open season should be further limited or even eliminated for a period of years[a] until the birds have recovered something of their former numbers. A reasonable limit to the day's bag should be set by law. Kansas, Maine, and Wisconsin restrict the number to 15; Montana and Oregon to 10, and Ohio to 6. Vermont, Pennsylvania, and Connecticut have a limit of 5 grouse per day to a gun, and in the latter State, as well as in New York, no more than 36 can be taken in a year. By similar laws other States can aid in the preservation of the bird.

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[a] Birds of Minnesota, p. 160, 1892.

The grouse in captivity often becomes tame. Sometimes, indeed, it takes kindly to the henhouse. It has laid in captivity, and its eggs found in the woods have been hatched under domestic hens, but thus far nothing like successful grouse culture has been approximated, though there appears to be no reason why under proper conditions it should not be successful. Comprehensive knowledge of the bird's food habits should assist in solving the problem.

FOOD HABITS.

The food habits of the ruffed grouse have been investigated in connection with the present paper by the examination of 208 stomachs and crops. This material represents food taken in every month, but chiefly in the colder half of the year. New York supplied more material than any other section; Canada, Pennsylvania, and Massachusetts came next; and Nebraska, Virginia, Maryland, Kentucky, New Hampshire, Iowa, Illinois, Minnesota, Michigan, Wisconsin, and South Dakota each contributed a smaller part. Analysis of the food showed 10.92 percent of animal matter and 89.08 percent of vegetable matter. The animal food is almost all insects. The vegetable food consists of seeds, 11.79 percent; fruit, 28.32 percent; leaves and buds, 48.11 percent, and miscellaneous vegetable matter, 0.86 percent. The insect food proper includes grasshoppers, 0.78 percent; caterpillars, 1.15 percent; beetles, 4.57 percent, and miscellaneous insects, 3.86 percent. Some miscellaneous animal matter, made up of spiders and snails, is also eaten. The ruffed grouse eats a somewhat smaller proportion of insects than the bobwhite, but, like it, feeds on them to a large extent in the breeding season.

INSECT FOOD.

Grouse shot by the writer at Chocorua, N. H., in September, 1898, were feeding largely on the red-legged grasshopper (*Melanoplus*

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[a] In Ohio the season has been closed until 1908, in Illinois until 1909, and in Missouri until 1910.

femur-rubrum), which was unusually abundant in pastures where the birds foraged. They had picked up also long-horned grasshoppers (*Xiphidium* sp.) and a few black crickets. Crickets often swarm in fields during fall, and offer tempting morsels to birds. The ruffed grouse occasionally eats such caterpillars as cutworms, army worms, cotton worms (*Alabama argillacea*), the red-humped apple worm (*Schizura concinna*), and the oak-leaf caterpillar (*Symmerista albifrons*). A number of observers, among them Doctors Fisher and Weed, report that it feeds on oak caterpillars.

The ruffed grouse, like the bobwhite, prefers beetles to any other insects. It takes almost as many of them as of all other kinds put together, including even such small ones as the clover weevil (*Sitones hispidulus*). It likes also the injurious leaf-eating beetles (*Chrysomelidæ*), destroying even the notorious potato beetle (*Leptinotarsa decemlineata*). It eats the pale-striped flea beetle (*Systena blanda*), as well as many other leaf beetles, including *Systena hudsonias*, *Disonycha caroliniana*, *Chætocnema* sp., *Galerucella sagittariæ*, and the grapevine pest, *Adoxus vitis*. By scratching, the grouse unearths many pests not found by other birds, notably beetle larvæ, click beetles, and May beetles, including *Lachnosterna hirsuta*. It also consumes another injurious beetle, *Dichelonycha* sp., closely related to the May beetles and resembling them in habits and appearance. It scratches up many ground beetles belonging to *Pterostichus*, *Anisodactylus*, *Harpalus*, and other genera. Beetles of other families also—fireflies (*Lampyridæ*), metallic wood borers (*Buprestidæ*), and *Calitys scabra* (*Trogostidæ*)—are in the food list.

The grouse feeds also on such miscellaneous insects as flies, bugs, ants, and such other Hymenoptera as sawflies and ichneumon flies. A large proportion of the flies are slow-flying species, like crane flies, which are preyed upon by many other kinds of birds. Bugs, however, are much more often destroyed by bobwhite and the ruffed grouse than by other birds. The ruffed grouse has been known to prey on the chinch bug, which at times is the most injurious insect in our country, and seldom destroyed by any except gallinaceous birds. Farmers who permit market hunters to rob them of their game should remember this fact. The grouse picks up also many other bugs, among them predaceous species like the ambush bug (*Phymata* sp.) and the assassin bug (*Reduviidæ*). They eat also homopterous insects, including leaf hoppers (*Jassidæ*) and buffalo tree hoppers (*Membracidæ*).

Like many other birds, the ruffed grouse eats ants, frequently including such large species as *Camponotus pennsylvanicus*. Among small ants may be mentioned the pavement ant (*Tetramorium* *cæspitum*). Several species of the useful parasitic ichneumons are occasionally taken, and as an offset such foliage-destroying insects as sawflies, including adult forms of *Nematus* sp. and larvæ of *Lophyrus* sp. A peculiar long-bodied hymenopteron (*Pelecinus* sp.) also has been noted. The queerest article of food, perhaps, is the galls produced by insects (*Cynipidæ*). The ruffed grouse shows a marked liking for these odd growths, which contain a few tiny larvæ. The common semidomestic pheasant of England has the same taste. The grouse usually selects galls growing on oaks, often those produced by species of the genus *Amphibolips*. A bird shot in Lunenburg, Mass., in October had eaten 12 of these oak galls, although at that time other food was abundant.

Few invertebrates other than insects were found in the investigation of the food of the grouse. The miscellaneous animal food, however, included representatives of such Myriapoda as the thousand-legs, of the order *Diplopoda*, and such Arachnida as harvest spiders (*Phalangidæ*), jumping spiders (*Attidæ*), and ground spiders (*Lycosidæ*); snails of the genus *Helix*, and also shell-less snails, or slugs, including *Limax* sp. and *Tebennophorus carolinensis*.

VEGETABLE FOOD.

The vegetable food examined consisted of 11.79 percent of seeds, 28.32 percent of fruit, 48.11 percent of buds and leaves, and 0.86 percent of miscellaneous vegetable matter. Grain was not found, though no doubt it would be eaten if obtainable. In fact, Major Bendire says that grouse procure it along roads from the droppings of horses.[a]

The seed element of the food is mast and miscellaneous seeds. The mast—5.33 percent—consists of hazelnuts, beechnuts, hornbeam seeds, chestnuts, and acorns. The last, furnishing by all odds the largest supply, includes those of the scrub oak (*Quercus nana*), scrub chestnut oak (*Q. prinoides*), white oak (*Q. alba*), and red oak (*Q. rubra*). Acorns are often swallowed whole, half a dozen to a dozen at a meal being not uncommon. Beechnuts also are taken whole, and from 20 to 60 are sometimes found in a crop.

Miscellaneous seeds make up 6.46 percent of the entire food. Like many other gallinaceous birds, the ruffed grouse takes some leguminous seeds, though fewer than might be expected. The kinds known to have been eaten are the tick-trefoil (*Meibomia* sp.), so abundant in the edge of woods frequented by grouse, and vetch (*Vicia caroliniana*). Winged seeds are often sampled, such as those of the hemlock, the pitch pine, and the maple. The following miscellaneous seeds are taken by the ruffed grouse:

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[a] Life Hist. N. A. Birds, [I], p. 62, 1892.

- Blackberry lily (*Belamcanda chinensis*).
- Beggar-ticks (*Bidens frondosa*).
- Chickweed (*Alsine media*).
- Sheep sorrel (*Rumex acetosella*).
- Sedge (*Carex lupulina*).
- Sedge (*Cyperus* sp.).
- Violet (*Viola* sp.).
- Witch-hazel (*Hamamelis virginiana*).
- Beech-drops (*Leptamnium virginianum*).
- Avens (*Geum* sp.).
- Persicaria (*Polygonum pennsylvanicum*).
- Frost weed (*Helianthemum canadense*).
- Jewel weed (*Impatiens* sp.).

The list is interesting mainly for what it does not contain. Further investigations may show that the ruffed grouse, like the bobwhite and other so-called granivorous species, is fond of ragweed, sunflower, and grass seed. A grouse taken in British Columbia during October showed a peculiar liking for the apparently dry husks of geum seeds, no fewer than 500 appearing in its crop.

BUDS AND LEAVES.

The ruffed grouse spends most of its feeding time in browsing and berry picking. It thus secures, respectively, 48.11 percent and 28.32 percent of its food. The country boy knows where it resorts for budding, and often bags it without the aid of a dog or hammerless gun. The buds and foliage of poplar, birch, and willow form 20.20 percent of the entire food. Budding is most practiced in winter and early spring, when many other kinds of food are buried in snow. Birch and poplar buds afford by far the largest share of this cold-weather diet. Edward A. Preble says that in Canada in spring the sitting hen grouse leave the nest, fly to poplar trees, rapidly fill their crops with buds, and then hurry back to their eggs. He thinks that the males, having plenty of time to spare at that season, prefer to search for choicer food. The crop of a hen bird that he shot at Fort Chipewyan, Athabasca, May 29, 1901, was filled with young leaves of poplar (*Populus balsamifera*). The number of buds to a meal is surprising. A grouse shot at Palmer, Mich., December 15, 1894, contained 300 poplar buds. When engaged in budding, grouse take both flower buds and leaf buds; grown leaves of poplar also are eaten, and, not infrequently, the flattened petioles that catch the wind and give the leaves their characteristic quiver. *Populus balsamifera*, *P. tremuloides*, and *P. grandidentata* are among the species on which they feed. Birch buds also are a staple; they are taken from the canoe birch (*Betula papyrifera*), the gray birch (*B. populifolia*), the yellow birch (*B. lutea*), and the black birch (*B. lenta*). Everybody who is familiar with New England woods has seen the grouse at dusk balancing on the ends of birch branches and snipping off buds. As with the poplar, both leaf buds and flower buds are taken. A grouse shot in Quebec December 18, 1896, had filled its crop with 200 catkins of the canoe birch. As a rule birds appear to prefer the male to the female flowers. Baird, Brewer, and Ridgway are authority for the statement that in Maine the buds of black birch are so freely eaten that they impart to the bird's flesh a distinctive and agreeable flavor. The ruffed grouse feeds also on the buds and leaves of different species of willow, as Major Bendire[a] and other authors have reported. A bird shot on Roseau River, Minnesota, October 20, 1896, had eaten 20 willow flowers. In budding, the grouse often clips from a fourth to half an inch of a twig which bears two or three buds.

In addition to the buds and leaves of willow, birch, and poplar, browse from miscellaneous plants provides the bird with 27.91 per cent of its food. Such relatives of the willow as the alder, hazel, beech, ironwood, and hornbeam furnish a part of the above. Apple trees on outlying parts of farms are favorite sources of supply. This fact, noted by many observers and confirmed by the present investigation, has given rise to considerable discussion as to whether or not the trees are seriously injured by the budding. Dr. Clarence M. Weed says:[b]

> The ruffed grouse, however, is capable of inflicting real damage by a too close pruning of buds, and cases are known where apple orchards located near woods have been rendered useless by them.

Mr. C. J. Maynard states that he took 180 apple buds from one crop, and says that in Massachusetts at one time a bounty of 25 cents was offered by certain towns for the birds' heads.[c] Miss M. E. Paine, of Royalston, Mass., in a letter to the writer describes her observations on the budding of apple trees by grouse as follows:

> The ruffed grouse eats the buds of apple trees, but it is a help rather than a damage. Last year a wild apple tree on top of a hill, between pasture and mowing, was almost entirely budded. I thought entirely at first, but the terminal buds were almost always left uninjured, also many minute buds on each limb. The result was the terminal buds were pushed out and grew rapidly and strongly. The tree blossomed abundantly and the fruit hung in clusters toward the ends of the branches. The tree is of medium size and the branches droop to the ground. In the fall the golden apples occupied fully as much room as the green leaves, and as one looked at the tree a few rods away—a perfect picture, barrels of apples on it, all nearly perfect and fair, just the result of a vigorous trimming. This year it was not so badly budded—less snow in winter. Many small buds farther back in the branches have started again this

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[a] Life Hist. N. A. Birds, [I], p. 66, 1892.

[b] Birds in Their Relation to Man, p. 40, 1903.

[c] Birds of Eastern N. A., p. 353, 1881.

year and grown, and it is well fruited, owing to the budding two years in succession. No tree could have been more entirely budded, but the grouse can not stand so as to reach the outmost terminal buds, as a rule; their weight is too great.

The present investigation of stomachs revealed only an insignificant percentage of apple buds, probably because most of the grouse examined were shot in places remote from orchards. The bird has been known to eat also pear and peach buds, and probably would not refuse cherry buds. From one crop, leaves of blackberry or raspberry (*Rubus* sp.) were taken, and bud twigs of blueberry (*Vaccinium pennsylvanicum*) and other species were not at all uncommon. The twigs severed by the sharp-edged bill of the grouse are all about the same length, one-third of an inch. They appeared in the stomachs as little whitish sticks, from which digestion had removed the bark. The extent to which the ruffed grouse browses on leaves and twigs suggests an herbivorous mammal rather than a bird.

The ruffed grouse feeds on leaves and buds of the mayflower (*Epigæa repens*), and likes exceedingly the leaves of the partridge berry (*Mitchella repens*). It nips off also leaves of both red and white clover, to the extent of 1 percent of its food. It is partial to the leaves of sheep sorrel (*Rumex acetosella*), which it cuts across as sharply as if by a pair of scissors, but it eats yellow sorrel (*Oxalis stricta*) with less relish. It appears to like dandelion greens, and has a queer taste for the fronds of ferns (*Dryopteris spinulosa*, *Botrychium obliquum*, and *Polypodium vulgare*). In its relation to conifers it differs widely from the spruce grouse, for it derives therefrom only an insignificant percentage of its food, while the spruce grouse obtains nearly 50 percent. Spruce needles and foliage of arborvitæ (*Thuja occidentalis*) have been seen in several stomachs. Edward A. Samuels believes that the ruffed grouse will eat leaves of evergreens only when all other food is lacking.[a] In Alaska, E. W. Nelson found the bird feeding exclusively on spruce buds. He states that the flesh becomes disagreeable from this pitchy diet.[b] The effect of highly flavored food on the flesh of game birds has already been referred to.

The ruffed grouse buds the highly poisonous laurel (*Kalmia latifolia*). On this subject Alexander Wilson writes:[c]

> During the deep snows of the winter, they have recourse to the buds of alder, and the tender buds of the laurel. I have frequently found their crops distended with a large handful of these latter alone; and it has been confidently asserted, that, after having fed for some time on the laurel buds, their flesh becomes highly dangerous to eat, partaking of the poisonous qualities of the plant.

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[a] Our Northern and Eastern Birds, p. 387, 1883.

[b] Nat. Hist. Coll. in Alaska, p. 131, 1888.

[c] Am. Ornith., vol. II, p. 319, 1831.

Dr. John H. Brinton, of Jefferson Medical College, has known several cases of glossitis (inflammation of the tongue) caused by eating grouse that had fed on laurel,[a] and Dr. N. Shoemaker has also known of serious illness from the same source.[b] V. K. Chestnut, Department specialist on poisonous plants, gave an extract made from laurel leaves to a chicken, which he subsequently killed and fed to a cat. The cat was seriously affected, but ultimately recovered. In Philadelphia in 1790 the public was alarmed over the possibilities of laurel poisoning, and the sale of these birds was for a time forbidden. Dr. B. H. Warren shot 10 birds when the ground was deeply covered with snow, and found their crops stuffed with laurel buds.[c] Not more than half a dozen stomachs of the 208 examined by the Biological Survey contained fragments of this plant, the explanation probably being that only a few stomachs were collected in late winter, when birds most resort to it. Four of the birds that contained laurel were used for food, with no evident ill effect. One of these had eaten 14 grams of laurel, nearly all leaves, with only a few buds. The leaves had been clipped into bits as if by scissors. Investigation of this habit of the grouse, known to be a common one, is much needed. The maple is often selected for budding, and sometimes the spicebush. Flowers are sometimes plucked by browsing grouse. Asters and red clover have been identified in their food, and the green ovary of bloodroot (*Sanguinaria*) was found in a bird's crop by Amos W. Butler.

The following plants also are in the list of browse of this bird:

Heuchera (*Heuchera americana*).
Chickweed (*Alsine pubera*).
Catnip (*Nepeta cataria*).
Cinquefoil (*Potentilla argentea*).
Buttercup (*Ranunculus bulbosa* and *R. acris*).
Speedwell (*Veronica officinalis*).
Saxifrage (*Saxifraga* sp.).
Live-forever (*Sedum* sp.).
Meadow rue (*Thalictrum* sp.).
Smilax (*Smilax glauca*).
Horsetail rush (*Equisetum* sp.).
Azalea (*Azalea* sp.).
False goat's beard (*Astilbe* sp.).
Aster (*Aster* sp.).
Cud weed (*Gnaphalium purpureum*).

FRUIT.

The ruffed grouse is preeminently a berry eater. Not only does it consume more fruit than the bobwhite, but it is our most frugivorous game bird. More than one-fourth of its yearly food—28.32 percent—consists of fruit, distributed as follows: 3.82 percent rose hips, 2.46 percent poison ivy and sumac, 3.01 percent grapes, and 19.03 percent miscellaneous fruits.

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[a] Warren, Birds of Penn., p. 108, 1890.

[b] North Am. Med. Journ., I, pp. 321–322, 1826.

[c] Birds of Pennsylvania, p. 108, 1890.

The taste for rose hips, seedy and husky as they are, and often beset with fine bristles which irritate the human skin and would seem really dangerous to internal tissues, is one of the singular freaks of bird feeding. It reminds one of the cuckoo's liking for caterpillars which are so bristly that its stomach becomes actually felted and sometimes pierced by the stiff hairs. Rose hips hang on the bushes throughout the winter, accessible to the hungry grouse as they journey about in the snow for food, and are usually swallowed whole.

The bird likes grapes also. No less than 3.01 percent of the year's diet consists of them, and in November they make 17.2 percent of the total food for the month. All experienced sportsmen know of this taste, and during this month they always count on getting their best shooting in the vicinity of heavily fruited grapevines. The wild grapes with small berries, such as *Vitis cordifolia*, are especially liked, but also large grapes are greatly relished. The species from which cultivated varieties have been derived (*Vitis labrusca*) appears to be commonly selected. Thirty to forty grapes are often swallowed at a meal. From this taste one might expect the grouse to commit depredations on cultivated grapes, but no reports of such damage have come to the Biological Survey.

Like many other birds, the ruffed grouse eats the berries of sumac and other species of *Rhus*. This food contributes 2.46 percent of the year's diet. Among the nonpoisonous sumacs selected are the dwarf sumac (*Rhus copallina*), the staghorn sumac (*R. hirta*), and the scarlet sumac (*R. glabra*). Not uncommonly from 300 to 500 berries of the dwarf sumac are swallowed at a meal. This liking for the dry and apparently nonnutritious sumac is another curious freak of bird appetite. Probably, as with the bobwhite, the seeds are broken up in the gizzard and the inclosed meat, or endosperm, set free for digestion. The immunity of the bird from poisoning by poison sumac and poison ivy, which also it eats, is interesting. That these seeds retain their virulence after being eaten was shown in the case of an investigator in the Biological Survey who was poisoned while examining stomachs of crows that had fed on poison-ivy berries. At times the ruffed grouse eats many of these berries, as proven by one collected by Prof. S. A. Forbes, at Jackson, Ill., December 9, 1880, which had eaten 280 of them. Where grouse are numerous, poison sumac is usually less abundant than poison ivy, and consequently it appears less frequently in stomach examinations. One hundred and sixty poison-ivy berries were taken from the crop of a ruffed grouse shot by Dr. A. K. Fisher at Lake George, N. Y., October 24, 1892.

Miscellaneous fruits amount to 19.03 percent of the annual food. The two favorite kinds are the partridge berry (*Mitchella repens*) and the thorn apple (various species of *Cratægus*), both of which were eaten by 40 of the 208 grouse examined. At least two species of thorn apple are used for food—the cockspur thorn (*Cratægus crus-galli*) and the scarlet thorn (*C. coccinea*). These apple-like fruits afford a nutritious food. At Peterboro, N. Y., the writer observed grouse coming to thorn-apple trees during November and well into December. That they take large numbers at a meal is shown by an individual obtained at St. Vincent, Minn., which had eaten 38. W. H. Kobbé says that grouse eat with great relish the small wild crab apple of the Northwest (*Pyrus rivularis*).[a] They enjoy cultivated apples, seldom missing a chance at trees on the edge of woodlands. At Chocorua, N. H., in October, 1898, some of the birds killed in old orchards of abandoned farms had fed principally on apples. After thorn apples and partridge berries, a number of other fruits are also staples. The large brilliant clusters of the mountain ash (*Sorbus americana*) are acceptable, and the delicious wintergreen berries, with scarlet skin and snowy pulp, are also relished. The bayberry (*Myrica carolinensis*) is a favorite food wherever accessible. In grouse stomachs one often finds nothing but the little round granules contained in the waxy drupes of this berry. Blueberries also are eaten in large quantities. A bird killed at Chocorua, N. H., July 25, 1892, had eaten a hundred blueberries (*Vaccinium pennsylvanicum*), and one killed at Chateaugay, N. Y., in September, contained about three hundred. The high-bush blackberry and the huckleberry also are eaten, as well as the cranberry. Dr. A. K. Fisher found 21 whole cranberries in a bird shot at Lake George, N. Y., November 2, 1901. The extent to which blackberries are sometimes eaten is shown by the fact that the stomach of a grouse contained about 800 blackberry seeds. Another bird had eaten over a hundred sarsaparilla berries. An explanation of the delicious flavor of the ruffed grouse appears in its varied and highly flavored diet of fruit, herbs, and seeds. In addition to the fruits already noted the following kinds found in the birds examined may be named, though the total number mentioned in this bulletin is probably not a fourth of the complete list of fruits eaten by this bird:

Greenbrier (*Smilax* sp.).
Hairy Solomon's seal (*Polygonatum biflorum*).
Smooth Solomon's seal (*Polygonatum commutatum*).
Blackberry (*Rubus nigrobaccus*).
Black raspberry (*Rubus occidentalis*).
Raspberry (*Rubus strigosus*).
Domestic cherry (*Prunus avium*).
Cultivated plum (*Prunus domestica*).
Wild black cherry (*Prunus serotina*).
Wild red cherry (*Prunus pennsylvanica*).
Elder (*Sambucus canadensis*).
Red elder (*Sambucus pubens*).
Black haw (*Viburnum prunifolium*).
Nannyberry (*Viburnum lentago*).
Withe rod (*Viburnum cassinoides*).
Maple-leaved arrow wood (*Viburnum acerifolium*).

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[a] Auk, XVII, p. 351, 1900.

High-bush cranberry (*Viburnum opulus*).
Mountain cranberry (*Vaccinium vitis-idæa*).
Snowberry (*Symphoricarpus* sp.).
Feverwort (*Triosteum perfoliatum*).
Black huckleberry (*Gaylussacia resinosa*).
Black alder (*Ilex verticillata*).
Flowering dogwood (*Cornus florida*).
Bunchberry (*Cornus canadensis*).
Cornel (*Cornus paniculata*).
Silky cornel (*Cornus amonum*).
Pepperidge (*Nyssa sylvatica*).
Mulberry (*Morus rubra*).
Bittersweet (*Celastrus scandens*).
Manzanita (*Arctostaphylos* sp.).
Barberry (*Berberis vulgaris*).
Virginia creeper (*Parthenocissus quinquefolia*).

The seeds of most of these berries pass through the digestive tract unharmed and are capable of germinating. Thus the grouse assists in planting many fruiting trees and shrubs, the heavy seeds of which must be disseminated mainly through the agency of animals that feed on them.

FOOD OF THE YOUNG.

The young of most birds are far more insectivorous than adults, a statement that applies to gallinaceous birds, though to a less extent than to passerines. More than 95 percent of the diet of eight grouse chicks examined, none of which was more than a fourth grown, was insects. Seven adults collected in the breeding season had consumed only 30 percent of insects. Newly hatched chicks eat the largest proportion of insects. As they grow older they gradually become more frugivorous and granivorous. Three chicks, only a day or two old, collected by Prof. S. A. Forbes, at Waukegan, Ill., June 9, 1876, proved to have been exclusively insectivorous. They had eaten cutworms, grasshoppers, Lampyrid beetles, ants (*Tetramorium cæspitum*), parasitic wasps, buffalo tree hoppers, and spiders (*Attidæ* and *Phalangidæ*). A grouse about a week out of the shell, collected by F. H. King, had eaten a white grub, 7 spiders (*Phalangidæ*), and 13 caterpillars.[a] It should be noted, therefore, that the ruffed grouse, though only slightly insectivorous when adult, as a chick destroys great numbers of insects, and deserves much more credit from farmers than it usually receives.

THE SPRUCE GROUSE.

(*Canachites canadensis.*)[b]

The spruce, or Canada, grouse inhabits the transcontinental coniferous forests from the northern border of the United States, east of the Rocky Mountains, to Labrador and Alaska. The male is one of the handsomest of the grouse; it is gray, with black bars above and clear black and white below, with a rusty band edging its fanlike tail. In spring brilliant red combs above the eyes add to the beauty of the strutting cock. These birds drum in an odd way: The male selects an inclined tree and flutters up the trunk for 15 to 20 feet, drumming as he goes. The spruce grouse nests in May or early June and lays from 9 to 16 buff-colored eggs, handsomely marked with rich chestnut and brown.

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[a] Trans. Wis. Ag. Soc., vol. 24, pp. 472–473, 1886.

[b] The spruce grouse (*Canachites canadensis*) is separated into three geographic forms, of which two occur within our territory; these are the common spruce grouse (*C. c. canace*) of the northern border from Maine to Minnesota, and the Alaska spruce grouse (*C. c. osgoodi*) of Alaska and western Canada.

FOOD HABITS.

Study of the food habits of the spruce grouse has been but meager, since only 8 stomachs were available for examination. These were collected in January, May, August, September, October, and November, 6 of them in Canada, 1 in Michigan, and 1 in Minnesota. The material in the stomachs consisted of 100 percent vegetable matter—18.33 percent seeds, 19.73 percent fruit, 61.94 percent coniferous foliage. The seeds were of spruce, thistle, and several unidentifiable plants. In its frugivorous habits the spruce grouse closely resembles its relative, the blue grouse. The proportion of bearberries was 16.67 percent, and of other fruit 3.06 percent. Solomon's seal (*Polygonatum*), blueberries (*Vaccinium*), bunchberries (*Cornus canadensis*), crowberries (*Empetrum*), and juniper berries are among the berries principally eaten. Dr. C. Hart Merriam, Chief of the Biological Survey, has informed the writer that the spruce grouse feeds largely on the bearberry (*Arctostaphylos uva-ursi*) and the wax currant (*Ribes cereum*).

When cold weather comes the spruce grouse usually abandons a berry diet and eats nothing but its favorite food—the leaves, buds, and tender shoots of conifers. This kind of browse formed 61.94 percent of the food of the eight birds examined in the laboratory. It is safe to assume that more than half the year's food of this grouse is obtained by browsing, and that nearly half consists of the foliage of conifers. Wilson and Bonaparte state that in winter this species feeds on the shoots of spruce,[a] a habit so generally known that it has given to the bird its name. According to Major Bendire, this grouse feeds also on the needles of tamarack (*Larix laricina*), and in certain localities feeds upon them exclusively.[b] It has been known also to eat the needles of *Pinus divaricata* and the fir balsam (*Abies balsamea*). As with the blue grouse, resinous food imparts to the flesh a decidedly pitchy flavor.

W. H. Osgood, of the Biological Survey, informs the writer that he examined crops of the Alaska grouse which contained the leaves of blueberry (*Vaccinium*) and horsetail (*Equisetum*). The Alaska spruce grouse, according to Dr. W. H. Dall, was found at Nulato in winter feeding exclusively on the buds of willow.[a]

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[a] Am. Ornith., vol. 4, p. 208, 1831.

[b] Life Hist. N. A. Birds, [I], p. 52, 1892.

The flesh of the spruce grouse is dark and for the table is in no way comparable to that of the blue grouse. Nor is the bird equal to the latter as an object of sport. It is, however, a thing of beauty in the dark northern coniferous forests, where its æsthetic value must impress every lover of nature. This grouse is strictly a forest bird, and nowhere appears to come into contact with agriculture.

THE FRANKLIN GROUSE.

(*Canachites franklini.*)

The Franklin grouse is very similar to its near relative, the spruce grouse, and differs mainly in the conspicuous white marking on its upper tail coverts and in lacking the rufous tip to the tail. It is found in the mountains of western Montana and Idaho, westward to the coast ranges of Oregon and Washington and northward through British Columbia to southern Alaska. Major Bendire records that nidification occurs during the last of May and in June. The food habits of the bird are similar to those of the spruce grouse. In Alberta, between August 25 and September 1, 1894, J. A. Loring, a field agent of the Biological Survey, examined the crops of several Franklin grouse and found in them berries and leaves. A. H. Howell, also of the Survey, examined crops and gizzards in Idaho during the last of September, 1895, and found in them large quantities of the leaves of the lodge-pole pine (*Pinus murrayana*) broken into bits from one-fourth to three-fourths of an inch long. Major Bendire notes that in summer they furnish Indians and packers with their principal supply of fresh meat. Their flesh is palatable then because they eat grasshoppers and berries and feed less freely on the buds and leaves of spruce and tamarack.[b]

Hon. Theodore Roosevelt writes of this bird in Montana:[c]

> The mountain men call this bird the fool-hen; and most certainly it deserves the name. The members of this particular flock, consisting of a hen and her three-parts grown chicks, acted with a stupidity unwonted even for their kind. They were feeding on the ground among some young spruce, and on our approach flew up and perched in the branches, four or five feet above our heads. There they stayed, uttering a low complaining whistle, and showed not the slightest suspicion when we came underneath them with long sticks and knocked them off their perches.

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[a] Nelson, Nat. Hist. Coll. Alaska, p. 130, 1887 (1888).

[b] Life Hist. N. A. Birds, [I], p. 58, 1892.

[c] The Wilderness Hunter, p. 116, 1893.

THE DUSKY GROUSE.

(*Dendragapus obscurus.*)[a]

The dusky, or blue, grouse lives mainly in coniferous forests of the western mountain ranges, occurring in the Rocky Mountains from New Mexico, Arizona, and Colorado, north to Canada and Alaska, and west to the Pacific coast. These grouse are large, plainly colored birds, mainly of a slaty or dusky shade. In unfrequented forests they are so unsophisticated that they often perch on a low branch and gaze curiously at an intruder until struck by a stone or stick. From their unsuspicious nature they are known in parts of the West, like the previous species, as fool-hens. While commonly habitants of the higher forests, they often descend to lower levels on the mountain sides where deciduous trees and bushes mingle with the conifers.

The dusky grouse is a valuable food bird and weighs from 2½ to 3½ pounds. Wilbur C. Knight says:[b]

> Of all the edible birds of the west this and the following variety [Richardson's grouse] are the most desirable. The flesh is highly flavored, tender, juicy, and as white as that of a tame fowl.

The flavor of a game bird's flesh is often affected by the character of its diet, as is the case with the blue grouse after it has been feeding on the pitchy foliage of conifers. "The use of such food imparts to the flesh of these birds," says Major Bendire, "a strong resinous flavor, not particularly relished by me at first."[c] Baird, Brewer, and Ridgway, however, state that the pine taste only improves the bird's gamy flavor.[d] Vernon Bailey states that half-grown young of the blue grouse which had been feeding largely on gooseberries were excellent eating, being entirely free from pitchiness. George B. Grinnell, editor of Forest and Stream, notes that a diet of a small species of red whortleberry also makes the flesh delicious.[e]

As an object of sport the blue grouse is in the front rank of game birds, even though it spends much time in the deep coniferous forests. It lies well to the dog, flies swiftly, and affords shots in heavy timber that test the sportsman's highest skill.

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[a] In addition to the common dusky grouse (*Dendragapus obscurus*) of the Rocky Mountains from New Mexico to Montana, three other geographic forms are known. These are the sooty grouse (*D. o. fuliginosus*) of the northwest coast, from California to southern Alaska; Richardson grouse (*D. o. richardsoni*), from Montana to northwestern British America; and the Sierra dusky grouse (*D. o. sierræ*) of the Sierra Nevada in California and east slope of Cascade Mountains in Oregon.

[b] Birds of Wyoming, p. 54, 1902.

[c] Auk, vol. 6, p. 33, 1889.

[d] Hist. N. A. Birds, vol. 3, pp. 424–425, 1874.

[e] Forest and Stream, vol. 12, p. 365, 1879.

The dusky grouse cock is quite uniformly dark in color, as the name implies. In the mating season the bird presents a striking appearance. The brilliant comblike wattles above its eyes are conspicuous, the large, yellow wind sacs on the sides of its neck are fully inflated, and it struts about like a turkey cock, with drooping wings and spreading tail, emitting a sound that closely resembles the hooting of the great horned owl. The nesting takes place during the last half of May, when the hen bird scratches a slight hollow in the earth and lays from 6 to 12 cream-colored, brown-spotted eggs. Usually but one brood is reared in a season. Prof. W. W. Cooke, in writing of the habits of the species in Colorado, says that it breeds from 7,000 feet altitude to timber line, 4,000 feet higher. At the former altitude it lays about the middle of May. In August the birds gather in flocks and visit grainfields, or frequent the more open gulches and foothills for berries. In September they wander above timber line to feed on grasshoppers, reaching an altitude of 12,500 feet. In severe winter weather some of the birds come down into the thick woods, but many remain the whole year close to timber line.[a]

FOOD HABITS.

The food habits of the dusky grouse have been studied by examination of the contents of 45 crops and stomachs, representing every month of the year except May, June, and November. Most of the birds were shot in British Columbia, Colorado, and Idaho, but a few came from Montana, Utah, Wyoming, and California. The food consisted of 6.73 percent animal matter—insects, with an occasional spider—and 93.27 percent of vegetable matter—seeds, fruit, and leaves. Grasshoppers constitute the bulk of the animal food, amounting to 5.73 percent. Beetles, ants, and caterpillars form the rest of the insect food. One stomach contained the common land snail (*Polygyra* sp.). Major Bendire, Vernon Bailey, and Walter K. Fisher have shown that the young birds feed largely on grasshoppers. Mr. Fisher shot a young bird at Forest Grove, Oreg., July 6, 1897, which had eaten 20 grasshoppers and several smooth, green larvæ.

Vegetable Food.

The dusky grouse and its near relative, the spruce grouse, are among our chief foliage-eating birds. Browse is eaten by the blue grouse to the extent of 68.19 percent of its annual food, and is distributed as follows: Buds and twigs, 5.28 percent; coniferous foliage, 54.02 percent; other leaves, 8.89 percent. The species spends most of its time in pine forests feeding on needles, buds, and flowers. The yellow pine (*Pinus ponderosa*)—male flowers, the white fir (*Abies concolor*), *Abies magnifica*, the Douglas fir (*Pseudotsuga mucronata*), the western hemlock (*Tsuga heterophylla*), and the black hemlock (*Tsuga mertensiana*) are among the trees that afford it subsistence. That the blue grouse thus utilizes the foliage of conifers is well known to everybody familiar with the bird. Major Bendire writes that during the winter its food consists almost wholly of the buds and tender tops of pine and fir branches, refuse bits of which sometimes accumulate under a single tree to the amount of a bushel.[a] A blue grouse shot by W. W. Price at Slippery Ford, Cal., when 15 feet of snow lay on a level, had filled its crop with the young leaves of the white fir.[b] Plants other than conifers furnish 14.17 percent of the annual food of the species. This material includes red clover leaves, willow leaves, blueberry leaves, miterwort (*Mitella breweri*), birch shoots, and poplar flower buds. During July, in Montana and Utah, field agents of the Biological Survey have seen the bird feeding on the leaves, buds, and flowers of the Mariposa lily (*Calochortus*). It eats also the blossoms of lupine, columbine, and the Indian paint brush (*Castilleja*).

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[a] Birds of Colorado, p. 70, 1897.

The blue grouse is only slightly granivorous. Its seed food amounts to but 4.99 percent of the whole—a proportion small indeed when compared with that of the bobwhite and the crested quails. The species is said by Alexander Wilson to resort to seeds only when other food is scarce.[c] At times it visits fields for oats and other grain. It feeds also on pine seeds (*Pinus flexilis* and other species). It picks up polygonum seeds (*P. polymorphum* and others), is fond of wild sunflower seeds, and has been known to sample false sunflower (*Wyethia mollis*), caraway (*Glycosma occidentalis*), and the capsules of *Pentstemon gracilis*. It picks up also the seeds of various species of lupine, and is fond of acorns, including those of the canyon live oak (*Quercus chrysolepis*).

The blue grouse is one of the most highly frugivorous of our gallinaceous birds. Fruit formed 20.09 percent of the food of the 45 birds whose stomachs were examined in the laboratory. Manzanita berries constituted a large part, amounting to 13.48 percent of the total. During the summer and early fall they were eaten in great quantities. The manzanita often forms tangled areas of chaparral and includes a number of species which furnish birds and mammals an abundant supply of berries. The berries eaten by the blue grouse include *Arctostaphylos pungens*, *A. nevadensis*, and *A. uva-ursi*. Its list of fruits also includes the following:

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[a] Auk, vol. 6, p. 33, 1889.

[b] Condor, vol. 3, p. 160, 1901.

[c] Am. Ornith., vol. 4, p. 191, 1831.

Mountain twin berry.
Red elder (*Sambucus pubens*).
Honeysuckle (*Lonicera involucrata; Lonicera conjugialis*).
Cherry (*Prunus* sp.).
Mountain ash (*Sorbus sambucifolia*).
Salmon berry (*Rubus parviflorus*).
Service berry (*Amelanchier alnifolia*).
Salal (*Gaultheria shallon*).
Huckleberry (*Vaccinium occidentale*).
Currant (*Ribes cereum, Ribes sanguineum*).
Gooseberry (*Ribes menziesii*).

The food habits of all young birds differ more or less from those of their parents. Young blue grouse at first live chiefly on grasshoppers and other insects and on tender plant tops. Later in the season they subsist on berries, such as gooseberries and salal-berries, and some seeds, such as those of the wild sunflower. Florence Merriam Bailey, in writing recently of the habits of the dusky grouse in New Mexico, says:[a]

> Near our camp at the foot of Pecos Baldy, Mr. Bailey discovered a winter roosting tree of the grouse. The tree was on a sheltered part of the wooded slope and was so densely branched that after a prolonged rain the ground beneath was perfectly dry. The earth was strewn with winter droppings, composed entirely of the leaves of conifers. Conifer needles had also been eaten by three of the grouse that were taken * * * in July and August, but at this season the birds were living principally on such fresh food as strawberries, bearberries (*Arctostaphylos uva-ursi*), sheperdia berries, flowers of the lupine and paint brush, seeds, green leaves, grasshoppers, caterpillars, ants, and other insects. One crop contained twenty-seven strawberries, twenty-eight bearberries, and twelve sheperdia berries, besides flowers, leaves, and insects, while the accompanying gizzard was filled with seeds, green leaves, and insects.

THE WILLOW PTARMIGAN.

(*Lagopus lagopus.*)

Ptarmigans are characteristic of the arctic and arctic-alpine regions. During summer they are mainly gray and brown, resembling the mottled colors of the bare earth, but at the approach of winter they change this plumage for one of pure white. Thus they harmonize with their surroundings at all seasons and are better able to escape their numerous enemies. There are four species of these birds in the United States and Alaska. Of these the willow ptarmigan, white ptarmigan, or willow grouse, as it is variously known, is the largest, most abundant, and consequently the most important. It is found in the arctic regions of both hemispheres, and is widely spread and abundant throughout the tundra country of Alaska, except on the Aleutian Islands. Throughout its range, especially in winter, it is an important food bird. In the north periods of famine are ever recurring among the natives, and these birds frequently stand between them and starvation. It rears but one brood in a season, nesting on the ground early in June and laying from 7 to 12 eggs. By the middle of August the young are nearly grown. In the northern part of its range the willow ptarmigan is a summer resident only, and at the approach of winter most of the birds migrate in large flocks, sometimes numbering a thousand or more, southward or inland to a region of scattered trees or bushes. Ernest Thompson Seton, quoting from Hutchins' manuscript concerning observations at Hudson Bay in 1782, says that over 10,000 ptarmigans were caught with nets at Severn from November to April.[a] The birds are so tame, especially in winter, that their capture is easy. Like all other gallinaceous birds, ptarmigans require gravel for milling their food, and in winter deep snow makes this hard to procure. The natives, taking advantage of the birds' necessities, bait their nets with gravel, and sometimes catch as many as 300 at one spring of a net.[b] E. W. Nelson writes of encountering flocks of several thousand white ptarmigans in Alaska in midwinter, and says that the whirring of their wings as they rose sounded like the roll of thunder and seemed to shake the ground. He reports that the birds are snared and shot in great numbers by both the Alaskan Eskimos and the Indians.[c] The flesh is not so palatable as that of many other game birds, and is decidedly dry and often bitter when the bird feeds on willow buds. The flesh of old birds is dark colored, but that of the young is white and delicately flavored.

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[a] Auk, vol. 21, p. 351, 1904.

FOOD HABITS.

Study of the food of the willow ptarmigan unfortunately has been slight, for only five birds were available. Their food was entirely vegetable. Three shot in January in Labrador had eaten 10 percent of berries and 90 percent of buds, more than half the buds being willow. One stomach contained about 300 willow-flower buds. The two other birds were collected in December in Labrador and had eaten willow buds exclusively. Though the data are so scanty, the results agree with those of other students. Ludwig Kumlien, for instance, says:[d]

> They [willow ptarmigans] are quite common in the larger valleys, where there is a ranker growth of willows. The stomachs of those I examined of this species contained willow buds and small twigs.

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[a] Proc. U. S. Nat. Mus., vol. 13, p. 514, 1890.

[b] Hearne, Journey to the Northern Ocean, pp. 413–415, 1795.

[c] Nat. Hist. Coll. in Alaska, p. 132, 1887 (1888).

[d] Bull. 15, U. S. Nat. Mus., pp. 82–83, 1879.

Baird, Brewer, and Ridgway have stated that the crops of ptarmigans were often found to contain a double handful of willow buds.[a] L. M. Turner writes thus of the bird in Alaska:[b]

> During the winter these birds subsist on the past year's twigs of willow and alder or other bushes. I have cut open the crops of many of these winter-killed birds and found them to contain only pieces of twigs about one-third of an inch long, or just about the width of the gape of the posterior horny part of the bill, as though this had been the means of measurement in cutting them off. The flesh at this time is dry and of a peculiar taste. In spring the ptarmigans congregate in great numbers on the willow bushes and eat the tender, swelling buds. The flesh then acquires a bitter but not unpleasant taste. As open weather advances they find berries that have remained frozen the entire winter, and tender grass shoots, and later, insects. The young are insectivorous to a great degree in their youngest days. They consume great numbers of spiders that are to be found on the warm hillsides.

In writing of the food of the willow grouse, Major Bendire says that the buds and tender leaves of birch are eaten, and the berries of cranberry, whortleberry, and arbutus.[c] Wilson and Bonaparte state that it feeds on berries, including the crowberry (*Empetrum nigrum*) and the mountain cranberry (*Vaccinium vitis-idœa*).[d]

THE ROCK PTARMIGAN.

(*Lagopus rupestris.*)[e]

The rock ptarmigan inhabits arctic America from Labrador to Alaska (including the entire Aleutian chain, where the willow ptarmigan is unknown). It is similar to the latter bird, but smaller and has a black line from the bill to the eye by which it may readily be distinguished. This bird is less common than the willow ptarmigan and prefers more rocky and elevated situations. Owing to its smaller size and fewer numbers it is far less important to the people of the north as an article of food than the willow ptarmigan.

FOOD HABITS.

No stomachs of the rock ptarmigan have been available for examination. In Alaska, during May, E. W. Nelson found it feeding on berries of the preceding season.[f] Major Bendire says that the subspecies *Lagopus rupestris reinhardi* feeds on insects, leaves, berries, including the crowberry (*Empetrum nigrum*), tender leaves of the dwarf birch and white birch, willow buds, and sorrel.[a] Samuel Hearne notes that the rock ptarmigan eats the buds and tops of the dwarf birch (*Betula glandulosa*).[b] Kumlien examined a crop that was crammed with sphagnum moss.[c]

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[a] Hist. N. A. Birds, Land Birds, III, p. 461, 1874.

[b] Nat. Hist. Alaska, p. 153, 1886.

[c] Life Hist. N. A. Birds, [I], p. 74, 1892.

[d] Am. Ornith., IV, p. 328, 1831.

[e] Besides the typical *Lagopus rupestris* of arctic America, the rock ptarmigans of North America include the Reinhardt ptarmigan (*L. r. reinhardi*), of Greenland and northern Labrador; the Welch ptarmigan (*L. welchi*), of Newfoundland; and four forms found in the Aleutian Islands—*L. r. nelsoni*, *L. r. atkhensis*, *L. r. townsendi*, and *L. evermanni*.

[f] Nat. Hist. Coll. Alaska, p. 136, 1887 (1888).

THE WHITE-TAILED PTARMIGAN.

(*Lagopus leucurus.*)

The white-tailed ptarmigan is found above timber line in Alaska, in the mountains of British Columbia, and in the higher Cascades south to Mounts Hood and Jefferson. It ranges south along the Rocky Mountains through Colorado to northern New Mexico. Unlike the other species, this ptarmigan has no black feathers in the tail. Writing of this bird in Colorado, W. W. Cooke says that it breeds above timber line, virtually under arctic conditions, and that only in most severe winters does it descend into timber. He records that it breeds at from 11,500 to 13,500 feet altitude, and wanders up to the summits of peaks 1,000 feet higher. Nesting takes place early in June and is similar to that of other ptarmigans. In winter, when the birds descend to lower altitudes, the sexes are in different flocks.

The white-tailed ptarmigan is a trusting creature, lacking the fear necessary for self-preservation. Clark P. Streator, while employed by the Biological Survey in the Cascade Mountains of Washington, reported that one could approach within 10 feet of it, that miners killed it with stones, and that it was very good for food.

In Colorado public sentiment is strongly in its favor, and it is protected by an absolutely prohibitory law. The ptarmigan is one of the sights pointed out to tourists in the Colorado mountains. Its status here may be contrasted with that of the willow grouse in the north, where thousands are killed by Eskimos and Indians. Killing birds for food, however, even by wholesale, has its excuse, but wholesale slaughter for millinery purposes, such as has overtaken the ptarmigans in the Old World, is unpardonable. A single shipment of ptarmigan wings in Russia consisted of 10 tons.[d]

FOOD HABITS.

During winter in Colorado, according to Professor Cooke, they subsist, like other ptarmigan, largely on willow buds. The stomachs of two birds collected at Summitville, Colo., in January, 1891, at an altitude of 13,000 feet, were found to contain bud twigs from one-third to one-half inch long, but the kind of bush from which they came could not be determined. Doctor Coues, quoting T. M. Trippe, states that the food of this bird is insects, leguminous flowers, and the buds and leaves of pines and firs.[a] According to Major Bendire, the flowers and leaves of marsh marigold (*Caltha leptosepala*) and the leaf buds and catkins of the dwarf birch (*Betula glandulosa*) are eaten.[b] Dr. A. K. Fisher examined the stomachs of two downy chicks collected on Mount Rainier, Washington, and found beetles and flowers of heather (*Cassiope mertensiana*) and those of a small blueberry.

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[a] Life Hist. N. Am. Birds, [I], p. 80, 1892.

[b] Journey to Northern Ocean, p. 416, 1795.

[c] Bull. 15, U. S. Nat. Mus., p. 83, 1879.

[d] Engelhardt, A Russian Province of the North, 1899.

THE WILD TURKEY.

(*Meleagris gallopavo.*) [c]

The wild turkey, our biggest game bird, was formerly abundant over a wide area. It has been exterminated throughout much of its former range, and unless radical measures are taken it will become extinct in a few years. In early colonial days it was numerous in Massachusetts, coming about the houses of the settlers in large flocks. It is now totally extinct in New England. It is hard to realize that at the beginning of the nineteenth century turkeys were so abundant that they sold for 6 cents apiece, though the largest ones, weighing from 25 to 30 pounds, sometimes brought a quarter of a dollar. A big wild turkey nowadays would not long go begging at $5. It is their value as food that has made it worth while to hunt turkeys to the very point of extermination. So-called sportsmen go out in the late summer ostensibly to shoot squirrels, but really to pot turkeys on the roost. Another practice is to lie in ambush and lure the game by imitating the call note of the hen in spring. The writer has personal knowledge of such methods of hunting in Virginia and Maryland, and they are largely responsible for the extermination now imminent. Trapping turkeys in pens—a very simple matter—has also accelerated the destruction of the species.

William Brewster found the turkey breeding in North Carolina among the conifers at 5,000 feet altitude, and also in the hardwoods at low altitudes. Edward A. Preble, of the Biological Survey, discovered a turkey's nest, in June, 1893, in Somerset County, Pa., which contained 14 eggs. William Lloyd states that the Texas turkey breeds twice a year. He found a nest, May 29, containing 8 eggs. The chicks, like those of the tame turkey, are very delicate, and are especially sensitive to wet. Audubon says that during wet weather they are fed by their mothers with the buds of spice bush, much as human youngsters are dosed with quinine.[a] When the chicks are 2 weeks old they fly up and roost on low branches with their mother. At this age they have weathered most of their early perils.

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[a] Birds of the Northwest, p. 427, 1874.

[b] Life Hist. N. A. Birds, [I], pp. 85–86, 1892.

[c] The typical *Meleagris gallopavo* is restricted to Mexico; but four geographic races have been recognized within the United States. These are the wild turkey of the Eastern States and the Mississippi Valley (*Meleagris gallopavo silvestris*); the Florida turkey (*M. g. osceola*); the Rio Grande turkey (*M. g. intermedia*); and the Merriam turkey of Colorado, New Mexico, Arizona, and the table-land of northern Mexico (*M. g. merriami*).

During the last of December, 1902, along the Roanoke River, near the North Carolina line, the writer found turkeys in typical turkey country. Few of the plantations here are under a thousand acres, and many include three or four thousand. Along the river are lowlands, often flooded during high water. Several hundred yards farther back is a bluff, the old river terrace, which marks the beginning of the uplands. A part of this bluff, half a mile long by an eighth of a mile wide, consists of a slate outcrop, much elevated above the rest and varying from 50 to 150 feet above the river. It is locally known as 'the mountain,' and is heavily forested with pine and oak. The turkeys were found on the backbone of the 'mountain,' among white oak trees, where fresh droppings and places where the birds had scratched in the dry oak leaves to the depth of 2 or 3 inches were visible. So recently had the birds been there that the humus had not dried. The scratching places were from 15 to 18 inches in diameter and circular in shape. In the growth of white oaks there were fully fifty scratching holes, as many as five being found within one square rod, where the birds had made diligent search for acorns. A turkey dog was sent ahead and soon flushed a bird, which came flying by, looking like a giant ruffed grouse. All through the woods were turkey blinds, some made of young pine trees and others, more elaborate, of logs. Most of the turkeys killed here are shot by calling them up to these blinds. In a patch of rank broomsedge and briers a 20-pound gobbler sprang into the air and was shot while making off in clumsy fashion. It had not had time to eat much, and the stomach and crop contained seven dipterous larvæ, the remains of white-oak acorns, and about a hundred flowering dogwood berries. On the 15th of June, 1903, two broods of young about the size of game hens were seen.

FOOD HABITS.

The Biological Survey has examined, in all, 16 stomachs and crops of wild turkeys. These were collected during February, March, July, September, November, and December. They contained 15.57 percent of animal matter and 84.43 percent of vegetable matter. The animal food consisted of insects—15.15 percent—and miscellaneous invertebrates, such as spiders, snails, and myriapods—0.42 percent. Grasshoppers furnished 13.92 percent, and beetles, flies, caterpillars, and other insects 1.23 percent.

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[a] Ornith. Biog., vol. 1, p. 7, 1831.

The 84.43 percent of the bird's vegetable food was distributed as follows: 'Browse,' 24.80 percent; fruit, 32.98 percent; mast, 4.60 percent; other seeds, 20.12 percent; miscellaneous vegetable matter, 1.93 percent.

The wild turkey is very fond of grasshoppers and crickets. William Hugh Robarts has observed a flock of a hundred busily catching grasshoppers.[a] Vernon Bailey, of the Biological Survey, killed a turkey at Corpus Christi, Tex., in May, 1900, that had eaten a large number of grasshoppers and a sphinx moth. During the Nebraska invasion of Rocky Mountain locusts, Professor Aughey examined the contents of six wild turkey stomachs and crops collected during August and September. Every bird had eaten locusts, in all amounting to 259.[b] The wild turkey has been known also to feed on the cotton worm[c] (*Alabama argillacea*), the leaf hoppers, and the leaf-eating beetles (*Chrysomela suturalis*). The grasshopper (*Arnilia* sp.) and the thousand-legs (*Julus*) form part of the turkey's bill of fare. Tadpoles and small lizards also are included.

Besides the bird shot on the Roanoke, already mentioned, the stomachs and crops of four other Virginia turkeys have been examined by the Biological Survey. One of these contained only small quartz pebbles. Another bird had eaten only a few grapes and flowering dogwood berries. A third had made a respectable meal. Ten percent of its food was animal matter and 90 percent vegetable. The animal part consisted of 1 harvest spider (*Phalangidæ*), 1 centipede, 1 thousand-legs (*Julus*), 1 ichneumon fly (*Ichneumon unifasiculata*), 2 yellow-jackets (*Vespa germanica*), 1 grasshopper, and 3 katydids (*Cyrtophyllus perspiculatus*). The vegetable food was wild black cherries, grapes, berries of flowering dogwood and sour gum, 2 chestnuts, 25 whole acorns (*Quercus palustris* and *Q. velutina*), a few alder catkins, seeds of jewel weed, and 500 seeds of tick-trefoil (*Meibomia nudiflora*). Another turkey, also shot in December, had eaten a ground beetle, an ichneumon fly, 2 wheel bugs, 10 yellow-jackets, a meadow grasshopper, 75 red-legged grasshoppers, a few sour-gum berries, some pine seeds (with a few pine needles, probably taken accidentally), several acorns, a quarter of a cupful of wheat, and a little corn.

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[a] Am. Field, vol. 55, p. 42, 1901.

[b] First Rep. Ent. Com., App. II, p. 46, 1878.

[c] Fourth Rep. Ent. Com., p. 88, 1885.

One turkey, collected December 23, 1899, in North Carolina, had eaten half a pint of dogwood berries. Its crop contained also a few pine needles. Four Florida wild turkeys also were examined. Nearly 100 percent of their food was vegetable. The animal matter was found in two birds and consisted of the useful predaceous ground beetle (*Scarites subterraneus*) and the injurious 12-spotted cucumber beetle (*Diabrotica 12-punctata*); also caterpillars (*Hadena turbulenta*), grasshoppers (*Melanoplus arboreus* and *Arnilia* sp.), 2 dragon flies (*Libellula* sp.), and 1 centipede. This is the only record of the first-mentioned grasshopper's occurrence in Florida. A third turkey had eaten half a pint of long-leafed pine seeds. Many of these seeds were germinating, and some of them had cotyledons more than an inch long. The Florida bobwhite also is very fond of these pine seeds. The same bird had eaten three thimblefuls of grass seed (*Panicum minimum*), 12 spicebush berries (*Benzoin benzoin*), 20 berries of the wax myrtle (*Myrica cerifera*), 2 live-oak acorns (*Quercus virginiana*), and 15 acorns of the Spanish oak (*Quercus digitata*). Another turkey had taken 25 tubers of the ground nut (*Apios apios*)—some of them exceeding an inch in length—and the berries of false Solomon's seal (*Polygonatum* sp.), southern tupelo, and wax myrtle. Half a pint of the fruiting panicles of a grass (*Muhlenbergia* sp.) was taken from the crop of a New Mexican turkey shot in November in the Manzano Mountains. It had eaten also grass blades, seeds of cheat, piñon nuts, and seeds of other pines.

Although grain was found in only one stomach, the writer observed turkeys on the Roanoke bottoms in December, 1903, feeding on corn after the crop had been harvested. During November and December half of the food of the turkey is fruit. The kinds most frequently eaten include, besides those already mentioned, myrtle holly (*Oreophila myrtifolia*), mulberries, wild strawberries, blackberries, cedar berries, and holly berries. On San Francisco Mountain, Arizona, Dr. C. Hart Merriam found turkeys in August feeding on wild gooseberries. A month later, at the same locality, he found them living on piñon nuts.[a] In Arizona E. A. Goldman found a flock of 150 young and old turkeys that roosted in one place. The gobblers were at this time in a separate flock. These birds were feeding on nuts of the piñon (*Pinus edulis*), a staple Indian food of the West. They ate also juniper berries (*Juniperus utahensis*).[b] On the upper Gila River, New Mexico, in November, 1873, H. W. Henshaw found turkeys very numerous and feeding almost exclusively upon grass seeds and grasshoppers, the crops of many birds being fairly crammed with the former. Major Bendire says that the Florida turkey feeds on white-oak acorns, chinquapins, chestnuts, pecan nuts, black persimmons, fruit of prickly pear, leguminous seeds, all cultivated grains, and tender tops of plants.[a] Wild turkeys feed also on mountain rice (*Oryzopsis pringlei*), mesquite beans, sedge, poa grass, and composite flowers.

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[a] N. A. Fauna, No. 3, p. 89, 1890.

[b] Auk, vol. 19, p. 123, 127, 1902.

Florence Merriam Bailey, in writing of the wild turkey in New Mexico, says:[b]

> Mr. Vilas, a cattleman of the country, told us that in the fall they go down to the nut pine and juniper mesas in the Glorieta region and, gathering at the few springs that furnish drinking places, are shot by wagon loads by the Mexicans. The only specimen we obtained was taken July 27, at over 11,000 feet. Its crop and gizzard held mainly grasshoppers and crickets, but also grass seed, mariposa lily buds, and strawberries, while its gizzard contained in addition a few beetles.

The wild turkey consumes both insect pests and seeds of weeds, but now is nowhere abundant enough to have much effect on agriculture. The domestic turkey's habit of hunting grasshoppers and of 'worming' tobacco shows what might be expected from the wild species were it sufficiently numerous.

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[a] Life Hist. N. A. Birds, [I], p. 114, 1892.

[b] Auk, vol. 21, p. 352, 1904.

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U. S. DEPARTMENT OF AGRICULTURE
BIOLOGICAL SURVEY—BULLETIN No. 25

BIRDS THAT EAT THE COTTON BOLL WEEVIL

A REPORT OF PROGRESS

BY

ARTHUR H. HOWELL

1862 1889

WASHINGTON
GOVERNMENT PRINTING OFFICE
1906

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., May 3, 1906.

Sir: I have the honor to transmit herewith for publication as Bulletin No. 25 of the Biological Survey a report of progress relating to the birds that feed on the boll weevil, by Arthur H. Howell. As a result of work in 1905 our knowledge of the part birds play in the destruction of the pest has been considerably extended, and several additions have been made to the list of species known to prey upon the boll weevil. The protection of these by law is earnestly recommended.

Respectfully,
C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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BIRDS THAT EAT THE COTTON BOLL WEEVIL.

INTRODUCTION.

The problem of controlling the ravages of the cotton boll weevil in the United States is of such moment that it is being studied by the Department of Agriculture from a number of different standpoints. One of these is the relation of birds to the weevil. Accurate information as to the value of our native birds as destroyers of this pest is of considerable importance to the cotton grower, but such information can be obtained only by means of careful and continued observation in the field, supplemented by study of the stomach contents of the birds. Field observations alone, unverified by stomach examinations, have proved unreliable. Birds may be observed picking insects from cotton plants, but it does not follow that the insects are boll weevils; nor is the statement that boll weevils have been found in birds' stomachs, if made by persons unaccustomed to the identification of insects, to be accepted as conclusive. Insect remains in a bird's stomach are nearly always in a more or less disintegrated condition, so that identification of the species is difficult and requires the services of a specialist.

Investigation of the problem was begun by the Biological Survey in the fall of 1904 under the direction of Vernon Bailey. The results of this study, with a summary of work done by the Bureau of Entomology, were published in a special bulletin by Mr. Bailey in 1905.[a] Stomachs of 38 species of birds were examined, and 11 species were found to have eaten boll weevils. The number of species known to feed on the weevil was increased to 20.

PROGRESS OF THE INVESTIGATION.

During 1905 investigations were continued by the Biological Survey, and particular attention was devoted to the seasons about which least was known—namely, the period from February to October.[b] The work was taken up by the writer early in July and continued until October 20. Stomachs of 62 species of birds were collected and examined, of which 12 species and 108 individuals were found to have eaten boll weevils.[a] Detailed results of the summer observations will be given later.

---

[a] Bulletin 22, Biological Survey.

[b] Field work was carried on by James H. Gaut in three localities in Texas for periods aggregating nearly six weeks, as follows: At Hempstead, February 21 to March 3; at East Bernard, May 2 to 17, and at Columbus, May 18 to June 1. A considerable number of birds' stomachs were obtained by him, but as no traces of the boll weevil were found in any of them they are not considered in the present bulletin.

COMPARISON OF SUMMER AND WINTER CONDITIONS.

During the growing season of cotton the adult weevils are concealed the greater part of the time on the buds, or 'squares,' where the enfolding bracts afford almost complete protection from most of their enemies; this fact largely explains why comparatively few weevils are eaten by birds during the summer months. The amount of time they spend on the wing and the distance they fly from place to place are not well known, but it is only during the period of maximum infestation that any considerable proportion of the insects can be found in exposed situations. After the first hard frost, weevils begin to leave the cotton plants and seek sheltered places in which to hibernate. During this period their numbers are materially reduced, but in favored seasons many weevils successfully pass the winter in their retreats. Rubbish piles about the borders of fields apparently furnish the most desirable hibernating quarters, and in such situations the weevils are exposed more or less to the attacks of ground-feeding birds. They are said to make use also of the hiding places afforded by the cotton and corn stalks which have been left standing.

Investigations thus far made show that while fewer weevils are destroyed by birds in winter than in summer, the number of species of birds that feed upon them in winter is somewhat greater. The birds which eat boll weevils in winter and spring and up to the time of the breeding season of the insects are more important economically than those which eat them in summer, for the reason that during the season of nonactivity of the weevils a relatively long period must elapse before they can make good the losses in their numbers, while during the breeding season weevils multiply with astonishing rapidity.

SUMMARY OF RESULTS.

As a result of the investigation of the relations of birds to boll weevils, details of which are given on succeeding pages, 28 species have been ascertained to feed on the weevil, as follows:

Killdeer.
Quail.
Nighthawk.
Scissor-tailed flycatcher.
Phœbe.
Least flycatcher.
Cowbird.
Red-winged blackbird.
Meadow lark.
Western meadow lark.

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[a] Examination of the stomachs was conducted in the laboratory by Prof. F. E. L. Beal and W. L. McAtee.

Orchard oriole.
Baltimore oriole.
Bullock oriole.
Brewer blackbird.
Great-tailed grackle.
Savanna sparrow.
Lark sparrow.
White-throated sparrow.
Cardinal.
Pyrrhuloxia.
Painted bunting.
Dickcissel.
White-rumped shrike.
American pipit.
Mockingbird.
Brown thrasher.
Carolina wren.
Black-crested titmouse.

Thirteen of the above species fed on the weevil during the summer months, and 17 during the winter months, 2 species feeding upon the insect both in summer and winter. About 18 percent of the stomachs of these birds contained boll weevil remains, and the total number of weevils eaten by them amounted to 40 percent of the number of birds examined.

The orioles prove to be the greatest destroyers of weevils in summer, and their near relatives, the blackbirds and meadow larks, in winter. Orioles, because of their bright plumage, have until recently been extensively used for millinery purposes, and thus their numbers have been much reduced. Thousands were slaughtered, not alone in the United States, but in Central America, where they pass the winter. In view of their great value as weevil destroyers every effort should be made to prevent their destruction for any purpose whatever. The same suggestion applies with almost equal force to the nighthawk, which is strictly insectivorous and is shown to be an enemy of the boll weevil. During the migrations the nighthawk occurs in certain sections of the South in great numbers and is frequently shot wantonly or for food. The bird should everywhere and at all times be protected.

In the case of an insect so destructive as the boll weevil, which has thus far defied all attempts at restraint and is steadily extending its ravages into new territory, every natural check to its increase should be encouraged. Though the extent of the services rendered by the avian enemies of the insect may sometimes seem small or even insignificant, in reality their cumulative effect is very important.

Birds are not the least important of the boll weevil's natural enemies, and every species ascertained to feed on it should be protected at all times and places, not only in the cotton-producing area, but along their migration routes. Of the birds known to eat the weevil the following are at present not protected in Texas: Killdeer plover, cowbird, red-winged blackbird, Brewer blackbird, and great-tailed grackle, or 'jackdaw.' Others, including some of the most valuable species, though protected by statute, are often wantonly destroyed through ignorance of the important work they perform.

There can be no question as to the usefulness of the killdeer, and it should be included among the species protected at all seasons. The economic position of the various species of blackbirds is not so clear. A study of their food made by Prof. F. E. L. Beal shows that some species, notably the Brewer blackbird and the great-tailed grackle, may at times be injurious to corn and other grain. However, the season in which blackbirds render the greatest service in destroying boll weevils, namely, winter and early spring, is not the season when they are likely to damage growing crops. And, furthermore, a very large proportion of the blackbirds leave Texas during the summer months. It seems, therefore, that in protecting them in winter, when they visit the cotton fields, the farmer is making no mistake.

In addition to protective bird laws the whole community should be informed as to the value of insectivorous species, with a view to the cultivation of popular sentiment in favor of their preservation. Without this sentiment, and the resulting coöperation on the part of the people, protective laws are of little value.

STATUS OF THE SPECIES OF BIRDS KNOWN TO EAT THE BOLL WEEVIL.

In the summary which follows, the results obtained by previous investigations are combined with those secured during the past season, thus bringing together all that is at present known concerning the relations of birds to boll weevils. The tables at the close furnish a partial list of the birds which have been examined in the course of the investigations, arranged according to the seasons, and show at a glance the species that have eaten weevils, the number of individuals of each species eating weevils, and the number of weevils eaten.

ORIOLES.

(*Icterus.*)

Observations carried on in 1905 indicate that in summer the birds most useful in destroying boll weevils are the three species of orioles occurring in the cotton belt of Texas—the orchard oriole, the Baltimore oriole, and the Bullock oriole. Of these the orchard oriole, although apparently less numerous than the Bullock oriole, is more generally distributed over the cotton-growing area, and is also the one which is the most successful weevil destroyer. Of the 84 specimens of this bird examined, 26, or about 31 percent, had eaten boll weevils; the total number of weevils taken by the 26 birds was 47, an average of nearly 2 to a bird, or 56 percent of all the birds examined.

The Baltimore oriole occurs as a summer resident in Texas only in the extreme northern and eastern portions, but during the migrations it is common throughout the State as far west at least as Karnes County. The 27 stomachs examined were taken between August 31 and September 22; six of them contained boll weevils, the total number of weevils found being 10, which is 37 percent of the number of birds examined.

The Bullock oriole is abundant in western Texas, but is not found much to the eastward of the longitude of Corpus Christi. It is abundant at Beeville and Runge, but is very rare at Cuero. Of the 144 specimens examined, 39, or about 27 percent, had eaten weevils; the total number of weevils eaten was 131, which is an average of more than 3 to a bird, or 91 percent of the number of birds examined.

All three species of orioles are migratory and spend only the spring and summer months in Texas. They usually arrive from the south between the 10th and 20th of April and depart late in September. It is unfortunate for the cotton growers that these useful birds do not remain in the State throughout the year, and it is likewise unfortunate that over the greater part of the cotton belt only one species, and that the smallest, is regularly found.

BLACKBIRDS AND MEADOW LARKS.

The blackbirds and meadow larks, which belong to the same family as the orioles (*Icteridæ*), seem to occupy a position complementary to that of the orioles as boll weevil destroyers—that is to say, they continue during the winter the good work which the orioles do in the summer. Nine species of this group occur abundantly in Texas in winter, and six of these are known to eat the boll weevil.

The meadow larks are represented by several slightly different forms or species, but since the food habits of all are practically identical they may be considered together. Two hundred and fifty-seven specimens have been examined, and of these, 40, or 15 percent, had eaten boll weevils, the total number of weevils eaten being 50. Examination of the records of the larks collected by Bailey in November and December discloses an interesting fact, namely, that about as many weevils were taken by them before the first hard frost as after the frost. This shows that the larks are able to find the weevils while they are feeding on the cotton plants as well as while they are hibernating, and indicates that wherever the larks occur in summer in the cotton belt they may be depended on to assist in the destruction of weevils. The greater portion of central and southern Texas is, however, deserted by the larks during the breeding season and until the middle or latter part of October. None were seen by the writer at any of the localities visited in the summer of 1905, except on the prairies between Richmond and Columbus.

Four species of blackbirds are known to consume boll weevils, the most important of which seems to be the Brewer blackbird (*Euphagus cyanocephalus*). Ten stomachs of this bird were examined by assistants of the Bureau of Entomology, and five of them contained a total of 11 boll weevils. This is the only species collected in winter in which the number of weevils eaten averages more than one to a bird, and if further investigations show this ratio to be the rule these blackbirds must be considered among the most useful of the winter visitants to Texas.

The big 'jackdaw,' or great-tailed grackle (*Megaquiscalus major macrourus*), was found to capture boll weevils in February, two of the eight birds taken in that month having eaten one weevil each. Six stomachs of the bird taken in summer contained no weevil remains.

The red-winged blackbird (*Agelaius phœniceus*) shows a smaller percentage of weevils taken than most of the other species of this family, but the enormous numbers of these birds which visit the cotton fields during the migrations give to their work a place of some importance. Sixty-three stomachs, nearly all taken in the fall and winter, have been examined, and two of them contained boll weevils.

The cowbird (*Molothrus ater*) is the only blackbird known to eat weevils both in summer and winter, but the number consumed in each case is small. Forty stomachs of this bird collected in winter showed only 1 weevil in the contents, and 54 stomachs taken in summer showed three containing 1 weevil each.

SPARROWS, GROSBEAKS, ETC.

(*Fringillidæ.*)

The members of this family are among the most abundant and generally distributed of Texas birds. Five species have been collected during the summer months and nine during the winter months. All five species taken in summer were found to have eaten the boll weevil, but in nearly every case the consumption of weevils was small. The only species which seems to feed upon them regularly at this season is the painted bunting, and considering the abundance of these birds and the fact that they feed extensively in the cotton fields, they must be considered an important factor in reducing the numbers of weevils. Eighteen birds, or nearly 17 percent of the number examined, had eaten boll weevils, but in only one instance was more than one weevil taken by a single bird.

The other species of this family which feed upon the weevil in summer are the western lark sparrow, the dickcissel, the cardinal, and the pyrrhuloxia; in winter, the white-throated sparrow and the western lark sparrow. The number of weevils eaten by all of these is insignificant.

FLYCATCHERS.

(*Tyrannidæ.*)

About ten species of flycatchers occur commonly in Texas, but only six of them are summer residents. Since these birds habitually capture their prey on the wing, they would not be expected to destroy large numbers of boll weevils, which, except during their annual migration, fly but little. Two species have been found to capture the weevils in summer and one species in winter.

The least flycatcher does not breed in the State, but is present in small numbers during the migration in August and September, and probably also in spring. In spite of its small size and aerial feeding habits the number of weevils eaten by this bird amounts to over 100 per cent of the number of birds examined, or an average of more than two weevils to each bird eating them.

The scissor-tailed flycatcher, although an abundant species, apparently destroys very few boll weevils. Only 4 of the 64 birds examined had eaten weevils, the total number of weevils eaten being 6.

The phœbe is the only flycatcher which passes the winter months in Texas. Thirteen stomachs taken in November and December have been examined, three of which contained one boll weevil each. This bird does not occur in Texas during summer.

NIGHTHAWK.

(*Chordeiles virginianus henryi.*)

The number of stomachs of this bird examined is too small to definitely settle its status as a boll weevil destroyer, but the fact that two of the four birds examined had eaten weevils, one having taken six weevils at a meal, indicates that the species is probably, at least at certain seasons, one of the most important enemies of the pest. This evidence should serve as an effective argument in favor of the preservation of the nighthawk.

These birds, commonly known as 'bull bats,' are often killed for food, particularly in Louisiana, Florida, and other Southern States, and they frequently serve also as targets for sportsmen who wish to try their skill as wing shots. In view of their importance as insect destroyers, nighthawks should at all times be rigidly protected.

QUAIL, OR BOBWHITE.

(*Colinus virginianus texanus.*)

Much has been written concerning the quail as a destroyer of boll weevils, and many persons believe that it consumes them in large numbers. Stomach examinations, however, fail to substantiate this theory, for among 144 stomachs examined only one contained a boll weevil. The bird that ate this one was killed at Seguin in November by Vernon Bailey. There is still one season of the year during which the quail has been imperfectly studied, namely, the period from January to June, inclusive, and it is possible that investigation during those months may result in a different showing for the bird. The ground-feeding habits of quail make it practically certain that few if any boll weevils are taken by them in summer.

KILLDEER.

(*Oxyechus vociferus.*)

One killdeer taken in February was found to have eaten three boll weevils. Further observations at the same season may not improbably produce additional evidence of this bird's value as a weevil destroyer. The killdeer frequents plowed fields, often in large numbers, and the destruction of weevils at the period of spring plowing is a highly important service. The present game law of Texas affords no protection to this bird, a defect which should be remedied by legislation. Meanwhile an enlightened public opinion should serve to prevent its destruction for any purpose.

MOCKINGBIRD.

(*Mimus polyglottos.*)

In view of the abundance of the mockingbird in and about the cotton fields, both in winter and summer, a study of its food habits with relation to the boll weevil is especially important. Sufficient data were obtained in the summer of 1905 to demonstrate that this bird feeds only sparingly upon the weevils at that season. Of the stomachs examined, only four, or about 5 per cent of the total number, contained boll weevils. Specimens taken in winter are too few to furnish conclusive evidence as to the mockingbird's value at that season. Only 11 winter specimens have been examined, and of these 2 contained 1 boll weevil each.

OTHER SPECIES.

There remain to be mentioned five species of birds, belonging to as many different families, which have been found to eat the boll weevil. They are the white-rumped shrike, the American pipit or titlark, the brown thrasher, the Carolina wren, and the black-crested titmouse. The most useful of these seem to be the titlark and the Carolina wren. The importance of both has been emphasized by Mr. Bailey in a previous bulletin, and no additional evidence has since been obtained. The titlark (*Anthus pensilvanicus*) is an abundant winter resident, and of the eight specimens collected three had eaten boll weevils.

The Carolina wren (*Thryothorus ludovicianus*) is common in winter, but rather rare in summer. Of the seven birds killed in winter five had eaten boll weevils.

The white-rumped shrike, or 'loggerhead' (*Lanius ludovicianus excubitorides*), was ascertained by assistants of the Bureau of Entomology to feed on boll weevils, two birds taken in December having captured one and four weevils, respectively. Examination of additional material, including nine stomachs taken in summer, furnishes no additional records of boll weevils eaten by this bird.

The two remaining species, the brown thrasher and the black-crested titmouse, find a place in the list of boll weevil destroyers on the strength of having eaten a single weevil each.

RESULTS OF OBSERVATIONS IN 1905.

STATUS OF THE BOLL WEEVIL.

The winter of 1904–5 was unusually severe in Texas, and the spring was remarkable for excessive rainfall over a large part of the cotton-growing area of the State. The months of July and August were characterized by extremely hot, dry weather. To what extent the winter climatic conditions reduced the numbers of weevils it is difficult to state, but it is certain that during the spring and early summer of 1905 weevils were much less numerous than they usually are at that season. This is shown both by the comparatively slight amount of damage done to the cotton crop during the early part of the growing season and by the small number of adult weevils found in July in many cotton fields known to have been seriously infested at a corresponding date in 1904. The entire absence of boll weevil remains from the stomachs of many species of birds known to eat the boll weevil, taken in February, March, and May, also indicates the extreme scarcity of the weevils at that season. Gaut examined several thousand young cotton plants at Columbus in May and was unable to find a single weevil. The writer visited the same locality the last week in July and found the infestation even then very slight. This was true of a number of other widely separated localities visited during June and July.

It is a well-established fact that dry, hot weather during the summer months is extremely effective in checking the increase of boll weevils, and their scarcity during the summer of 1905 is partially explained by the prevalence of such weather. While in some localities during the late summer, weevils increased sufficiently to do a moderate amount of damage, at other localities which had suffered greatly from their ravages in 1904 the damage during 1905 was inconsiderable, and even as late as September very few adult weevils could be found at these localities.

The entire season, therefore, was not favorable for obtaining conclusive results with regard to the relations of birds and weevils. Observations during a season in which weevils are more abundant would doubtless show a larger number of species of birds feeding upon them and a greater number of weevils consumed per bird.

CONDITIONS OF BIRD LIFE IN THE SUMMER OF 1905.

Birds were abundant at only two localities visited in the summer of 1905. At three localities they were moderately numerous, while at five localities they were very scarce. During the month of July, which includes the last part of the breeding season of most species, they were scarce at all localities visited. At Gurley, Texas, on July 20, a count was made of all the birds seen to visit a large cotton field in the river bottom, bordered on two sides with woods and thickets. Forty individuals of 10 species were noted in about six hours in the area under observation, which included about 100 acres. This result is fairly typical of conditions prevailing in other localities visited during the same month, except in regions where the presence of cotton worms offered an especially attractive food supply.

The greater part of August and September was spent at two localities in the arid mesquite belt of Texas—Beeville and Runge—and here birds, both resident species and migrants, proved to be abundant. Between September 23 and October 20 a number of different localities were visited, from Medina County on the west to Waller and Grimes counties on the east, and at every place a marked scarcity of bird life in and about the cotton fields was noted. Peculiarities in the distribution of the food supply, not as yet well understood, probably account in a measure for this scarcity. The tendency of certain species of birds after the breeding season to wander in search of food is quite pronounced. This habit is well illustrated by observations on the varying abundance of cuckoos, mentioned later.

SUMMARY OF OBSERVATIONS IN 1905.

Cuero, July 6–7.—At this time the cotton plants were in fine condition, 3 to 4 feet high and full of blossoms and bolls. Weevils were very scarce, some fields being moderately infested and others not at all. No adult weevils could be found, and the average number of larvæ in fallen squares was about 12 to every 100 hills.

Birds were not abundant, and practically the only species seen feeding among the cotton plants was the orchard oriole. Of this species only one small flock was seen, and but one of those taken had eaten a boll weevil.

Gurley, July 10–22.—Cotton was in about the same condition here as at Cuero the previous week, perhaps a little less advanced.

Weevils were more abundant than at Cuero, though it was practically impossible to find adults. Forty hills in the worst infested fields were carefully searched without finding a single individual. Examination of all the fallen squares under 20 hills produced 34 larvæ, 4 of which were dead.

Birds were fairly common, and the following species were seen in the cotton fields: Quail, downy woodpecker, scissor-tailed flycatcher, wood pewee, orchard oriole, lark sparrow, cardinal, painted bunting, purple martin, and mockingbird. The orchard oriole and the painted bunting were the most numerous and were the only ones seen feeding among the cotton plants. Of the stomachs examined from this locality only about 5 percent contained boll weevil remains. Four of the 18 orchard orioles examined had eaten a total of 6 boll weevils, and 2 of the 20 painted buntings examined had eaten 1 weevil each.

Cameron, July 24–26.—Cotton was in the same flourishing condition here as at Cuero and Gurley.

Weevils were by this time quite numerous. Twenty-five hills of tall cotton in a bottom-land field were searched and 9 adult weevils found, most of them crawling on the upper part of the stalks. Over 50 percent of the squares in this field were infested.

Birds were rather scarce, the only species which were at all numerous in the cotton fields being the orchard oriole, lark sparrow, scissor-tailed flycatcher, and quail. Of the 9 orchard orioles taken, 4 had eaten a total of 7 weevils. One painted bunting and 1 least flycatcher were taken, each of which had eaten a boll weevil.

Columbus, July 28–29.—Cotton was well advanced here, as at localities previously visited, but many of the fields had been attacked by the cotton leaf-worm, which proved to be very attractive food for the birds. Weevils were very scarce, some fields being very slightly infested, others containing from 5 to 10 percent of infested squares. Birds also were rather scarce, the only species seen in any numbers being the orchard oriole. Of 8 orioles examined, 2 were found to have eaten 1 weevil each.

Beeville, August 3–22.—During this period cotton picking was in full progress, and although in some fields the dry weather was beginning to retard the formation of new buds, many blossoms were opening every day.

Weevils were abundant and quite evenly distributed. On August 7 the fallen squares were collected from 20 hills of cotton, and in them were found 74 weevil larvæ, 39 of which were dead, evidently as a result of the hot weather. On August 20, 50 hills were examined for adult weevils, and 43 individuals found. The cotton leaf-worm had appeared only in very small numbers and in isolated spots.

Birds were abundant about the borders of the fields, in the mesquite thickets, and along roadsides. Large numbers of certain species also visited the cotton fields daily. Of the birds collected here, about 15 percent had taken the boll weevil, 41 individuals of 8 species having eaten a total of 129 weevils. During the early part of the month (August) the most abundant species of bird in the cotton fields was the painted bunting (*Cyanospiza ciris*). From 100 to 200 of these birds were seen in a single field nearly every morning. After about the middle of the month, however, their numbers became much reduced, and by the 20th the average number seen in a day was not over 15. To some extent they fed on the ground, but spent much time climbing among the cotton stalks. They were partial also to weed patches. Thirteen birds, or about 15 percent of those examined, had eaten weevils, only one having taken more than a single weevil at a meal.

Even more abundant than the painted bunting was the lark sparrow (*Chondestes grammacus strigatus*), but unfortunately its ground-feeding habits preclude the possibility of its destroying the boll weevil on a large scale. Lark sparrows fairly swarmed along roadsides and in the more open portions of cotton fields, but only one of those examined contained a boll weevil.

The dickcissel (*Spiza americana*), another of the native sparrows, having habits somewhat similar to those of the lark sparrow, was found in the cotton fields in considerable numbers. Its record as a weevil consumer was somewhat better than that of the lark sparrow, for of the 19 birds examined 2 had eaten 1 weevil apiece.

One of the commonest birds at Beeville was the handsome pyrrhuloxia (*Pyrrhuloxia sinuata texana*), a large, thick-billed sparrow or grosbeak, related to the cardinal. The favorite haunts of these birds are the mesquite thickets, but they not infrequently visit the cotton fields. Two of those collected had each eaten a boll weevil.

The birds which proved to be the most important enemies of the boll weevil were the Bullock oriole (*Icterus bullocki*) and the orchard oriole (*Icterus spurius*), but unfortunately neither of these was very abundant. The orchard oriole, as in other localities where observations were made, habitually fed among the cotton stalks. Seventeen individuals were collected, and of these, 8 had eaten a total of 23 weevils. The largest number taken by a single bird was 7, and another had taken 6. The Bullock orioles, though more numerous than their smaller cousins, were seen less frequently in the cotton, their favorite haunts being the mesquite thickets. Twenty-seven individuals were collected in and near the cotton fields, and of these 27 birds 12 had eaten a total of 80 weevils. The greatest number eaten by a single bird was 41, and 2 others had eaten 11 and 9, respectively. These three birds, all of which were adults, were taken, together with five young birds, about 9 a. m. on August 16, while feeding in a cotton field. Of the five young, one had eaten two weevils and another three. These records would seem to show that the orioles know perfectly well where the weevils hide and seek them as a chosen article of food. At this season practically all the weevils are concealed beneath the enfolding bracts of the buds, or 'squares,' and it is improbable that a bird could capture as many as 41 during a single morning without opening the bracts in search of them. It is significant also that the adult orioles, naturally having a better idea of where to hunt for weevils, consumed a much larger number of them than the young ones.

In addition to the four species of sparrows and two species of orioles found feeding on the weevils, there were also two species of flycatchers which captured them in small numbers. The scissor-tailed flycatcher (*Muscivora forficata*), though quite numerous in the pastures and along roadsides, visited the cotton plants very infrequently. Eleven individuals were collected, one of which had taken two boll weevils, and this one, strangely enough, was taken in a mesquite pasture at some distance from the cotton fields. The least flycatcher (*Empidonax minimus*), which was present in small numbers as a migrant, was occasionally seen to visit the cotton stalks, and of the three individuals collected two had taken boll weevils, one having eaten four, the other, one.

In addition to the birds already mentioned, the following species were more or less numerous in the cotton fields: Mockingbird, quail, yellow warbler, great-tailed grackle, cardinal, and curve-billed thrasher.

Runge, August 23–September 5; September 11–23.—During the first half of this period the growth of cotton had practically ceased, as the result of protracted drought. During the latter half, after a few light showers, the cotton plants began to put forth new buds and leaves. The cotton leaf-worms were very abundant at this locality; nearly all the fields had been attacked by them, and over large areas the plants had been entirely denuded of leaves and buds.

Weevils were quite abundant, but by reason of the ravages of cotton worms they had been forced to concentrate on the small patches of cotton containing leaves and buds. In such places they averaged about 2 weevils to a hill, the greatest number found in one spot being 19 on 5 hills. In the fields where cotton worms were still at work the weevils averaged about one to every two hills.

Birds were abundant in and about the cotton fields, and in the mesquite thickets. Cotton worms furnished a much more attractive and easily obtained food supply for the birds than weevils, as was shown both by field observations and by stomach examinations. Birds were much more numerous in fields infested with the cotton worms than in those which were uninfested, and in the case of certain species their presence or absence in a given locality was largely determined by the abundance of these insects. This was notably true of the yellow-billed cuckoos, which on August 23 were found in large numbers about an isolated field where cotton worms were abundant; but on September 2, after this brood had all pupated, not a single cuckoo could be found there, although they were still numerous in fields a few miles away.

Cotton worms were contained in the stomachs of nearly every species of bird collected at Runge, and they formed a large percentage of the food of many species, notably the cuckoos, orioles, and mockingbirds, which were the commonest birds in the fields. The consumption of weevils by the birds therefore was probably less than it would have been had there been no cotton worms.

Nine species of birds were found feeding on weevils in this locality, 52 individuals, or more than 12 percent of those examined, having eaten a total of 88 weevils. As in other localities visited, orioles were the greatest consumers of weevils, although the proportion of weevils to birds killed was larger in the records of the nighthawk and of the least flycatcher.

The nighthawk (*Chordeiles virginianus henryi*) was quite numerous, but unfortunately it was not suspected of eating weevils, so that only four specimens were taken. Of these, 2 had eaten weevils; one collected on August 25 had eaten 6, and one on September 15, one weevil. The first of these was shot while flying over a cotton field, the other while resting on a tree, both at about 10 a. m. In the first instance 2 of the 6 weevils were almost entire, showing that they had been captured only a short time before. Since these birds invariably feed on the wing, the weevils must have been flying at the time they were captured.

The least flycatcher was present in small numbers, and 4 individuals were taken, 2 of which had eaten weevils—one eating 4, the other, one. The scissor-tailed flycatcher, a much more abundant species, captured only a small number of weevils. Of the 30 individuals collected, 2 had eaten a total of 3 weevils.

Three species of orioles were present at this locality—the orchard oriole, the Baltimore oriole, and the Bullock oriole, the last being the most abundant and also the greatest destroyer of weevils. Of 30 orchard orioles examined, 7 had eaten a total of 8 weevils. In this portion of Texas the Baltimore oriole is a migrant only. The first arrivals from the North were seen on September 13, and during the next ten days they were common. Five of those examined had eaten a total of 9 weevils. The Bullock oriole is a common breeder here, and they were still numerous at the time of the writer's departure. Although partial to mesquite trees, they were occasionally seen in cotton fields, and the stomach examinations show that about one-fourth of those killed had eaten weevils. In all, 27 stomachs of this bird were found to contain a total of 51 weevils, the largest number eaten by a single bird being 5. The small percentage of weevils taken, in comparison with the number taken by the same species at Beeville, is explained by the greater abundance of cotton worms at Runge. Practically all the orioles of the three species taken at the latter place had eaten either the caterpillars or the chrysalids of the cotton worm, and these insects formed more than 80 percent of their food.

Both the cardinal and the painted bunting were found to be eating the weevils, but neither species was abundant. Four cardinals were examined, 2 of which had eaten a weevil. Fourteen painted buntings were taken, 2 of which had likewise eaten 1 weevil apiece.

Mockingbirds were very common, and many were seen in the fields feeding on cotton worms. Twenty-nine specimens were collected, 3 of which had taken 1 weevil apiece.

Other localities.—During September and October five additional localities were visited, as follows: Castroville, September 25; Seguin, September 26–29; Matthews, Colorado County, September 30–October 4; Hempstead, October 6–9, and Navasota, October 10–16. Cuero was also revisited September 6–9 and Gurley, October 17–20. At these localities, with the single exception of Cuero, weevils were found in considerable numbers, but at most places birds were remarkably scarce, and the stomachs of those collected contained no weevil remains. At Matthews, in the Colorado River bottoms, red-winged blackbirds and bronzed grackles were abundant, though comparatively few of them fed in the cotton fields.

SCHEDULE OF STOMACH EXAMINATIONS.

In the following lists are enumerated all the species thus far examined in connection with boll-weevil investigations.[a]

Record of birds examined which had eaten boll weevils.

Species.	During Jan., Feb., and Mar.			During Apr., May, and June.			During July, Aug., and Sept.			During Oct., Nov., and Dec.		
	No. of birds examined.	No. eating boll weevils.	No. of boll weevils eaten.	No. of birds examined.	No. eating boll weevils.	No. of boll weevils eaten.	No. of birds examined.	No. eating boll weevils.	No. of boll weevils eaten.	No. of birds examined.	No. eating boll weevils.	No. of boll weevils eaten.
Killdeer (*Oxyechus vociferus*)	2	1	3	....	....	....	4	....	....	1	....	....
Texan quail (*Colinus virginianus texanus*)	....	....	....	....	....	....	36	....	....	108	1	1
Western nighthawk (*Chordeiles v. henryi*)	....	....	....	....	....	....	4	2	7	....	....	....
Scissor-tailed flycatcher (*Muscivora forficata*)	....	....	....	....	....	....	62	4	6	....	....	....
Phœbe (*Sayornis phœbe*)	....	....	....	....	....	....	....	....	....	13	3	3
Least flycatcher (*Empidonax minimus*)	....	....	....	....	....	....	10	5	11	....	....	....
Cowbird (*Molothrus ater*)	16	1	1	....	....	....	54	3	3	24	....	....
Red-winged blackbird (*Agelaius phœniceus*)	3	....	....	....	....	....	11	....	....	49	2	2
Meadow lark (*Sturnella magna* and subspecies)	3	....	....	....	....	....	....	....	....	183	28	32
Western meadow lark (*Sturnella neglecta*)	....	....	....	....	....	....	....	....	....	66	12	18
Orchard oriole (*Icterus spurius*)	....	....	....	....	....	....	84	26	47	....	....	....
Baltimore oriole (*Icterus galbula*)	....	....	....	....	....	....	27	6	10	....	....	....
Bullock oriole (*Icterus bullocki*)	....	....	....	....	....	....	144	39	131	....	....	....
Brewer blackbird (*Euphagus cyanocephalus*)	5	3	9	....	....	....	....	....	....	5	2	2
Great-tailed grackle (*Megaquiscalus major macrourus*)	8	2	2	2	....	....	6	....	....	2	....	....
Western savanna sparrow (*Passerculus s. alaudinus*)	....	....	....	....	....	....	....	....	....	18	1	1
Western lark sparrow (*Chondestes grammacus strigatus*)	....	....	....	3	....	....	51	1	1	....	....	....
White-throated sparrow (*Zonotrichia albicollis*)	....	....	....	....	....	....	....	....	....	9	1	1
Cardinal (*Cardinalis cardinalis*)	....	....	....	....	....	....	25	2	2	9	....	....
Texan pyrrhuloxia (*Pyrrhuloxia sinuata texana*)	....	....	....	....	....	....	53	2	2	....	....	....
Painted bunting (*Cyanospiza ciris*)	....	....	....	....	....	....	107	18	19	....	....	....
Dickcissel (*Spiza americana*)	....	....	....	....	....	....	23	3	3	....	....	....
White-rumped shrike (*Lanius l. excubitorides*)	1	....	....	....	....	....	9	....	....	12	2	5
American pipit (*Anthus pensilvanicus*)	....	....	....	....	....	....	....	....	....	8	3	4
Mockingbird (*Mimus polyglottos*)	6	2	2	2	....	....	73	4	4	5	....	....
Brown thrasher (*Toxostoma rufum*)	....	....	....	....	....	....	....	....	....	29	1	1
Carolina wren (*Thryothorus ludovicianus*)	....	....	....	....	....	....	....	....	....	7	5	6
Black-crested titmouse (*Bæolophus atricristatus*)	....	....	....	....	....	....	1	....	....	2	1	1

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[a] Including those examined by Bureau of Entomology.

Record of birds examined which had not eaten boll weevils. [a]

Species.	Number of birds examined during—			
	January, February, March.	April, May, June.	July, August, September.	October, November, December.
Mourning dove (*Zenaidura macroura*)	2	......	115	112
Mexican ground dove (*Columbigallina p. pallescens*)	......	......	......	5
Yellow-billed cuckoo (*Coccyzus americanus*)	......	......	45	......
Texan woodpecker (*Dryobates scalaris bairdi*)	......	......	4	2
Red-headed woodpecker (*Melanerpes erythrocephalus*)	......	......	......	3
Red-bellied woodpecker (*Centurus carolinus*)	......	......	1	2
Golden-fronted woodpecker (*Centurus aurifrons*)	......	......	4	......
Flicker (*Colaptes auratus*)	......	......	......	3
Kingbird (*Tyrannus tyrannus*)	......	......	8	......
Wood pewee (*Contopus virens*)	......	......	4	......
Yellow-bellied flycatcher (*Empidonax flaviventris*)	......	......	3	......
Blue jay (*Cyanocitta cristata*)	......	......	......	2
Rusty blackbird (*Euphagus carolinus*)	......	......	......	10
Bronzed grackle (*Quiscalus quiscula æneus*)	......	......	3	3
Western vesper sparrow (*Poœcetes gramineus confinis*)	......	......	......	11
Western grasshopper sparrow (*Coturniculus s. bimaculatus*)	......	......	......	5
White-crowned sparrow (*Zonotrichia leucophrys*)	......	......	......	4
Western tree sparrow (*Spizella monticola ochracea*)	......	......	......	5
Fox sparrow (*Passerella iliaca*)	......	......	......	9
Towhee (*Pipilo erythrophthalmus*)	......	......	......	6
Blue grosbeak (*Guiraca cærulea*)	......	......	3	......
Purple martin (*Progne subis*)	......	......	4	......
Nashville warbler (*Helminthophila rubricapilla*)	......	......	4	......
Yellow warbler (*Dendroica æstiva*)	......	......	20	......
Mourning warbler (*Geothlypis philadelphia*)	......	......	3	......
Curve-billed thrasher (*Toxostoma curvirostre*)	......	......	6	......
Texan Bewick wren (*Thryomanes bewickii cryptus*)	......	......	3	2
Blue-gray gnatcatcher (*Polioptila cærulea*)	......	......	10	......
Bluebird (*Sialia sialis*)	......	......	......	6

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[a] A few species of which only one or two specimens have been examined are omitted from the list.

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U. S. DEPARTMENT OF AGRICULTURE

BIOLOGICAL SURVEY—BULLETIN No. 26

C. HART MERRIAM, *Chief*

DISTRIBUTION AND MIGRATION OF NORTH AMERICAN DUCKS, GEESE, AND SWANS

BY

WELLS W. COOKE

Assistant, Biological Survey

1862 1889

WASHINGTON
GOVERNMENT PRINTING OFFICE
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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BIOLOGICAL SURVEY,
Washington, D. C., July 10, 1906.

SIR: I have the honor to transmit herewith, for publication as Bulletin No. 26 of the Biological Survey, a report on the Distribution and Migration of North American Ducks, Geese, and Swans, by Wells W. Cooke, assistant in the Biological Survey. Formerly abundant over the whole of the United States, waterfowl are steadily diminishing in numbers, and some species appear to be threatened with extinction in the not distant future. Their value for food is great, and they have formed in the past, and for all future time should continue to form, a valuable asset and an important source of revenue to the several States which harbor them. The preservation of the numerous species of ducks, geese, and swans is becoming an important matter of legislative enactment, and the present report is intended to furnish information as to present range, abundance, and migration of the several species with reference to practical legislation.

Respectfully,

H. W. HENSHAW,
Acting Chief, Biological Survey.

Hon. JAMES WILSON,
Secretary of Agriculture.

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DISTRIBUTION AND MIGRATION OF NORTH AMERICAN DUCKS, GEESE, AND SWANS.

INTRODUCTION.

Wild fowl are distributed over the whole world. From time immemorial ducks, geese, and swans have been held in high esteem by mankind, and everywhere they have been eagerly pursued for sport or for food.

Passing by the purely esthetic value of the birds as beautiful and welcome denizens of our waters and as lending the charm of life and animation to our otherwise desolate ponds and lakes; passing by, too, their importance to thousands of men who are lured from business cares to pursue them and who derive from their pursuit both health and pleasure, their economic value and importance as food are very great. The flesh not only is palatable and nutritious, but is so different from that of domestic fowls as to form a most welcome addition to the table both of the rich and the poor.

The flesh of wild fowl constituted an important item in the larder of the aborigines of this country, who, by means of the bow and arrow and by the use of various devices in the shape of nets and traps, succeeded in obtaining them in considerable numbers, especially when young and unable to fly. The Eskimo and northern Indians, indeed, would fare badly but for the vast numbers of waterfowl that visit their country to breed, and everywhere the aborigines seek their eggs with avidity. Waterfowl as an addition to the larder became almost as essential to the first settlers as they had been to the Indians, and, so far as game was concerned, the fowling piece soon became a more important part of the settler's equipment than the rifle.

Neither the aborigines nor the early settlers appreciably reduced the numbers of the hordes of ducks and geese that periodically covered the lakes, ponds, rivers, and marshes of this favored country. It was not until comparatively recent times, indeed, that the tremendous increase of population and the constantly increasing number both of sportsmen and of market gunners, together with the invention of that potent engine of destruction, the breech-loading gun, have had their logical effect in greatly diminishing their numbers and in practically exterminating not a few species.

So rapidly are some species diminishing in numbers in certain States that the market supply is already threatened, and Minnesota has found it necessary to pass laws prohibiting not only the export of ducks, but even their sale within the State limits. Such radical legislation in a State where only a few years since waterfowl abounded on every lake and waterway, reveals how imminent is the danger and how pressing the value and importance of prohibitive laws, and it becomes evident that if any considerable number of waterfowl are to be preserved, spring shooting must be abolished and the sale of wild fowl limited to the States where killed.

The enforcement of moderately stringent protective laws, however, and the establishment of preserves in the States where waterfowl can be sure of shelter and safety, are likely to result not only in averting the threatened extinction of certain species, but in the increase of all waterfowl to a point somewhere near their recent abundance. Should the lessons of the past be unheeded and protection be withheld for a few years, then measures of the most radical kind will be necessary.

Of the 64 species and subspecies of ducks, geese, and swans which occur in North America north of Mexico, 24 breed in the United States. The species most important to us are the wood duck, mallard, black duck, teal, canvasback, redhead, and Canada goose. Several of these species breed only in the Northern States; but the cinnamon teal and ruddy duck nest as far south as southern California, and the wood duck breeds almost everywhere throughout the United States, and, moreover, the great bulk of this species winters within our boundaries.

It is a sad commentary on our present system of game protection that the wood duck, one of the handsomest of our native birds and one whose breeding range is almost entirely within our boundaries, is the species which has suffered most. So persistently has this duck been pursued that in some sections it has been practically exterminated. Even in States in which it still breeds commonly, as in Delaware and Maryland on the Atlantic coast and in Illinois in the Mississippi Valley, public sentiment fails to recognize the importance of adequately protecting the bird, and the laws still permit it to be destroyed late in the spring. As a result the wood duck is constantly diminishing in numbers, and soon is likely to be known only from books or by tradition.

PROTECTION.

Wherever waterfowl already breed, or where the conditions are such as to favor their remaining during the summer, every effort should be made to increase the number of breeding birds by adequate protection both in the spring and during the nesting season, and, wherever possible, game refuges or preserves suitable for breeding purposes should be established.

Protective laws intended to shorten the open seasons, to prohibit spring shooting, eliminate destructive methods of hunting, and to stop sale and export have often provoked opposition from those who maintain that it is futile to attempt the protection of migratory birds in the North if they are not equally well protected on their winter feeding grounds in the South.

Recent experience, however, shows that under certain circumstances the results of local protection are immediate and very striking. In the San Luis Valley, Colorado, protection afforded ducks within an inclosure about an artificial pond, fed by an artesian well, has caused the birds to resort to the pond in increasing numbers each winter. At Palm Beach, Fla., where no hunting is allowed within a mile of the town, ducks have become so tame that they will come within a few feet for food, while outside the mile limit the same birds are so wild that it is difficult to approach them within gunshot. In Jefferson County, N. Y., the enactment of a local law prohibiting spring shooting has resulted in several species remaining to breed which formerly went much farther north to lay their eggs, when continually harassed by constant hunting in the spring. The enactment of a State law in New York prohibiting the shooting and sale of ducks and geese in spring has not only had a marked effect on local birds, but has resulted also in extending protection to waterfowl in North Carolina by restricting in the latter State their slaughter for the markets of New York City.

These and other illustrations which might readily be cited show that, if protected, many species that formerly reared their young in the United States, and were driven away by persecution, would return and occupy old breeding grounds. They prove also that very effective work for the protection and increase of waterfowl can be done in many sections of the country without waiting for general legislation or for concerted action on the part of the Southern States. Cooperative legislation on the part of the Southern States is greatly to be desired and may be expected to follow as the causes that have led to the diminution in the numbers of waterfowl are better understood there and as the purpose and effects of protective legislation in Northern States are fully comprehended.

With reference to practical legislation in behalf of wild fowl, questions often arise as to the time when various species may be expected at certain points in the autumn, when they leave for their breeding grounds in the spring, how late in the season shooting can be continued without interfering with pairing, what progress in legislation has been made in different parts of the United States, and what have been the practical results of such legislation.

In order to enable the Department to answer such inquiries, a comprehensive investigation of the general facts relating to our wild fowl has been undertaken. In the present report are presented such data as are now available respecting the distribution and migration of the ducks, geese, brant, and swans of North America, together with a brief reference to a few species which occur in Panama and the West Indies. A summary is also given of existing information as to the breeding grounds occupied by the several species, their winter resorts, the routes selected in passing north and south, and the times of making their journeys. Other subjects of investigation still under way are the food habits of the various species, principal ducking grounds, methods of hunting, and the means which have thus far proved most successful in the protection of these birds.

The problem of the legal protection of ducks, geese, and swans has two phases—protection during the breeding season and protection during migration and in winter. The first phase concerns 24 species of ducks breeding in the United States, while 46 species come under the head of winter residents of the United States. It happens, however, that from the economic point of view the 24 species of ducks and geese that breed in the United States comprise the most important North American species; among this number also are all the species that at the present time need protection while breeding. Of the 24 species, 5 are numerically unimportant and are confined to the southern portions of the United States and southward, so that they are of little importance for the market and as objects of sport. These 5 are the Florida duck, mottled duck, masked duck, black-bellied tree-duck, and fulvous tree-duck.

The other 19 species that breed regularly and commonly in the United States are as follows:

American merganser, *Merganser americanus.*
Hooded merganser, *Lophodytes cucullatus.*
Mallard, *Anas boschas.*
Black duck, *Anas obscura.*
Gadwall, *Chaulelasmus streperus.*
Baldpate, *Mareca americana.*
Green-winged teal, *Nettion carolinense.*
Blue-winged teal, *Querquedula discors.*
Cinnamon teal, *Querquedula cyanoptera.*
Shoveler, *Spatula clypeata.*
Pintail, *Dafila acuta.*
Wood duck, *Aix sponsa.*
Redhead, *Aythya americana.*
Canvasback, *Aythya vallisneria.*
Lesser scaup, *Aythya affinis.*
Ring-necked duck, *Aythya collaris.*
Ruddy duck, *Erismatura jamaicensis.*
Canada goose, *Branta canadensis.*
White-cheeked goose, *Branta canadensis occidentalis.*

A glance shows that this list comprises the species that in later years have decreased most in numbers, and hence that most need protection.

CAUSES OF DECREASE IN NUMBERS OF WATERFOWL.

The principal causes of the diminished numbers of waterfowl have been market hunting, spring shooting, and the destruction of the breeding grounds for farming purposes. Previous to twenty years ago, market hunting was the principal factor in the steady diminution of waterfowl. Since 1885, however, the problem of duck preservation in North America has entirely changed. The prairie districts of central Canada, comprising large portions of Manitoba, Saskatchewan, and Alberta are the "ducks' paradise." Within the United States this favored region extends to the northeastern part of Montana, the northern half of North Dakota, and the northwestern corner of Minnesota. The whole vast region is crowded with lakes, ponds, sloughs, and marshes that furnish ideal nesting conditions and unlimited food. Forty years ago every available nook was crowded with waterfowl, and the whole region, 200 miles wide by 400 miles in length, was a great breeding colony, and numbered its inhabitants by the hundreds of thousands. To the northward the forests formed a partial boundary; to the southward, the general absence of suitable breeding grounds was the controlling factor, restricting the breeding waterfowl to the few lakes and marshes. The number of breeding ducks decreased rapidly from central North Dakota southward, until the outposts were reached in the lake region of southern Wisconsin, the Kankakee marshes of Illinois and Indiana, a few favored spots in southwestern Minnesota, and the lakes of north-central Iowa. In southern Wisconsin in 1864, every pond hole and every damp depression had its brood of young ducks. During the next fifteen years the farming of the region changed from grain raising to dairying, the marshes were drained, the former duck nurseries became grazing grounds, and duck hunting there was a sport of the past.

An article written in 1877 on the birds of northeastern Illinois enumerates 12 species of ducks as breeding commonly in the vicinity and 3 others as occasionally found there in summer. At present, a brood of young ducks in this region is rare. In 1885 some 14 species bred near Clear Lake, Iowa, and 16 species at Heron Lake, Minnesota. Now scarcely any ducks breed at either lake. But the places just mentioned were merely the outskirts of the "ducks' paradise." As great a change has taken place in the very heart of the breeding grounds. The Northern Pacific Railroad cut across its southern border in Minnesota and North Dakota and this was soon followed by a north and south line to Winnipeg. Other shorter branches were built later, but the final doom of the ducks was apparent when the Canadian Pacific Railroad crossed between Winnipeg and the Rocky Mountains the finest duck breeding grounds on the continent. During the past decade, the last stronghold of the waterfowl has been invaded, and soon the great breeding colonies of northern Alberta and Saskatchewan will be of the past. The population of North Dakota increased many fold from 1880 to 1900, and during this same period the vast prairies of central Canada were changed to wheat fields. It is evident, therefore, that in the United States and southern Canada in a few years there will be no great breeding colonies of the ducks most valued for sport and for the table. The future supply must come from isolated pairs and small colonies scattered in favorable localities over Canada and the northern quarter of the United States. Fortunately, such favorable places exist and will continue to exist for many years.

An important question in connection with the protection of ducks is the time when they pair for the breeding season, since it is evident that if shooting is continued after the birds are paired a decided decrease in the number of broods will result. While the present state of knowledge does not warrant positive statements as to the exact date of pairing of each species, enough has been learned to show that in the case of many species pairing occurs before the breeding grounds are reached. Many if not most of the mallards and shovelers that pass through Illinois on their way to more northern breeding grounds are paired before they leave that State, and the same is true of these species in Iowa. Many black ducks, wood ducks, and teal are paired in the spring by the time they reach Massachusetts. The following letter from Hon. John E. Thayer is of interest in this connection:

> I am absolutely positive that mallards, black ducks, gadwalls, widgeons, green-winged and blue-winged teal, shovelers, and pintails begin mating at Currituck Sound, North Carolina, by February 15. By the 1st of March they are mated. The law should protect them then, for if one is shot, the other will keep flying about until within easy range. There is not a shadow of doubt that the ducks I have named are mated before they migrate, and if we do not want to exterminate them, laws should protect them from the time they leave the South.

Above have been outlined the causes, past and present, of the great diminution in the numbers of the ducks. The practical problem of to-day is the present and future preservation of the remnant. It goes without saying that all ducks should be protected during the breeding season. Notes in the following pages under the different species show the dates at which the earliest eggs have been found, and from these dates it is easy to determine the beginning of the breeding season. The wood duck, in northern Florida, begins nesting by the middle of February and the black duck, in Massachusetts, by April 20. It follows, therefore, that at the very latest these ducks should not be disturbed in Florida after February nor in Massachusetts after April 1. These dates apply to corresponding latitudes in the Mississippi Valley, and the 1st of May would be the latest date for Minnesota and North Dakota. On the Pacific slope the corresponding nesting dates are from late March in southern California to late April in the State of Washington.

Protection during the breeding season is the least that any friend of the ducks would advise. The present rapid diminution in the number of waterfowl can not be stayed, however, by such partial measures. Nothing short of the absolute prohibition of spring shooting in every part of the country should be advocated by those who believe that duck shooting should be enjoyed by future generations.

Another phase of protection relates to the proper regulation of shooting during the fall and winter. This phase concerns a much larger number of species of waterfowl than the question of hunting during the breeding season. For although only 24 species nest within the United States, 46 species are found here during winter, as will appear from the following lists:

WINTER RANGES.

Species that Winter Principally in the United States and Southward.

Hooded merganser,[a] *Lophodytes cucullatus.*
Mallard, *Anas boschas* (on the Pacific coast to the Aleutian Islands).
Black duck, *Anas obscura.*
Red-legged duck, *Anas obscura rubripes* (occasional in winter in Nova Scotia).
Florida duck, *Anas fulvigula.*
Spotted black duck, *Anas fulvigula maculosa.*
Gadwall, *Chaulelasmus streperus.*
Baldpate,[a] *Mareca americana.*
Green-winged teal, *Nettion carolinense.*
Blue-winged teal,[a] *Querquedula discors.*
Shoveler,[a] *Spatula clypeata.*
Pintail,[a] *Dafila acuta.*
Wood duck,[a] *Aix sponsa.*
Redhead,[a] *Aythya americana.*
Canvasback,[a] *Aythya vallisneria.*
Scaup duck. *Aythya marila* (rare in southern Canada and on the Pacific coast to the Aleutians).
Lesser scaup duck,[a] *Aythya affinis.*
Ring-necked duck,[a] *Aythya collaris.*
American golden-eye, *Clangula clangula americana* (rare in southern Canada, and on the Pacific coast to the Aleutians).
Buffle-head, *Charitonetta albeola* (on the Pacific coast to the Aleutians).
Ruddy duck,[a] *Erismatura jamaicensis.*
Lesser snow goose,[a] *Chen hyperborea.*
Greater snow goose, *Chen hyperborea nivalis.*
Blue goose, *Chen cærulescens.*
Ross goose, *Chen rossii.*
American white-fronted goose, *Anser albifrons gambeli.*
Canada goose,[a] *Branta canadensis.*
Hutchins goose,[a] *Branta canadensis hutchinsii.*
White-cheeked goose, *Branta canadensis occidentalis.*
Cackling goose,[a] *Branta canadensis minima.*
Brant, *Branta bernicla glaucogastra.*
Black brant, *Branta nigricans.*
Fulvous tree-duck, *Dendrocygna fulva.*
Whistling swan,[a] *Olor columbianus.*
Trumpeter swan,[a] *Olor buccinator.*

Species that Winter in the United States and Canada.

American merganser, *Merganser americanus.*
Red-breasted merganser, *Merganser serrator.*
Barrow golden-eye, *Clangula islandica.*
Old squaw, *Harelda hyemalis.*
Harlequin duck, *Histrionicus histrionicus.*
American eider, *Somateria dresseri.*
Spectacled eider, *Somateria spectabilis.*
American scoter, *Oidemia americana.*
White-winged scoter, *Oidemia deglandi.*
Surf scoter, *Oidemia perspicillata.*

If ducks are to be protected for reasons other than esthetic, there must be an open season. Most will agree that so far as the perpetuation of species alone is concerned this open season should be during migration, and preferably during the fall migration. The data presented later in this bulletin show that ducks begin to leave their breeding grounds late in August, but that active migration does not occur until September. A shooting season in northern New England or the northern portion of the Mississippi Valley that began September 1 would satisfy the demands of conservative sportsmen of these sections. In the southern United States, however, this date would anticipate by a full month the time when enough ducks arrive to make hunting worth while, and at Currituck Sound, North Carolina, shooting does not begin until November.

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[a] Winters also in southern British Columbia.

In the northern half of the United States the great body of ducks and geese depart with the advent of freezing weather, and but few linger after early November. On the other hand, south of the Ohio River and Chesapeake Bay the ducks and geese remain all winter, and, unless protected, will be harassed throughout the entire cold season. The greatest slaughter of ducks now occurs in the section named, especially in the Mississippi Valley from southern Missouri southward, and here more stringent laws are needed. It is claimed above that the shooting season should be confined to the period of migration, and if this is true then it follows that fall shooting should cease as soon as, or soon after, fall migration has ceased. Regular migration has closed by the first of December, and though the birds are constantly shifting their position all through the winter as the weather changes, these movements can hardly be called migration.

MIGRATION.

Ducks, geese, and swans are migratory. While many breed under the torrid sun of the Tropics, others migrate to the most distant parts of the world for the purpose of nesting. As far into the frozen north as land extends geese summer and successfully rear their young.

A few species are nonmigratory, and individuals of other species, as the ruddy duck, remain through the year near the nesting grounds; but most of the ducks and geese are strictly migratory and some perform extensive journeys. The brant of northern Greenland, for instance, probably spend the winter along the South Atlantic coast of the United States. Some of the blue-winged teal that nest in southern Canada desert North America in fall and cross the equator to spend the winter in central South America. Some of the pintail ducks of Alaska and northeastern Asia cross the equator to the islands of the South Pacific, 4,000 miles from their breeding grounds.

Most waterfowl, in migrating, follow the same route both in spring and fall. The ducks that migrate north along the Mississippi River in spring probably are the same individuals that traversed this route the previous autumn. Among the geese there is a single exception to this rule. The common eastern brant (*Branta bernicla glaucogastra*) in spring passes north along the Atlantic coast to the Gulf of Saint

Lawrence, thence almost due north for 2,000 miles to its breeding grounds, but it is practically unknown in the interior of Canada. In the fall many thousands migrate along the west shore of Hudson Bay and from its southern borders cross to the Atlantic coast. Thus the migration route is in the form of an ellipse some 3,000 miles long north and south by 1,000 miles wide.

Probably in no other region in the world do so large a proportion of the birds migrate approximately north and south as in North America north of the Gulf of Mexico. The outlines of the coast, the courses of the large rivers, and the trend of the mountain chains unite to make northward and southward migration easy and natural. In the case of ducks, however, there is a factor that causes thousands of individuals of several species to take a northwest-and-southeast route. The Atlantic coast from Chesapeake Bay to South Carolina is especially favorable as a winter home for ducks and until recent years countless flocks swarmed throughout this district. Such other birds as winter in this region breed principally in New England and northward along the Atlantic slope to Labrador. But northeastern North America east of Hudson Bay harbors only a small number of ducks in summer. They prefer the marshes, lakes, and streams of the districts west of Hudson Bay, and the great bulk of North American ducks breed there. Thus there are two great districts, one suitable for a summer home and the other for winter, and the migration route between them is nearly northwest and southeast, between Chesapeake Bay and Great Slave Lake. Through much of the intervening 2,000 miles is a succession of lakes, large and small, that find no counterpart elsewhere on this hemisphere, and which furnish ideal conditions for ducks, both as regards food and shelter.

Among the most conspicuous species that follow this migration route are the redhead, canvasback, and greater scaup. Less abundant, though still numerous, are the baldpate, pintail, and lesser scaup, while the route is extensively used also by the mallard, gadwall, shoveler, and ring-necked duck. Nearly all the individuals of these 10 species that winter along the Atlantic coast reach their winter home by a pronounced southeastward migration, though it must be understood that these individuals constitute only a small percentage of the vast army of these same species that breed in central Canada.

One of the principal winter homes of North American ducks and geese is the State of California, where congregates during this season the larger part of all the individuals that breed west of the Rocky Mountains.

DISTRIBUTION.

The family of ducks, geese, and swans is represented in North America by 63 species and 8 subspecies—a total of 71 recognized forms; but the following 7 of these do not range so far north as the United States:

Species occurring in Central America, West Indies, or Mexico, but not known to reach the United States.

Muscovy duck, *Cairina moschata.*
Diaz duck, *Anas diazi.*
Abert duck, *Anas aberti.*
Bahama duck, *Pœcilonetta bahamensis.*
White-faced tree-duck, *Dendrocygna viduata.*
Whistling duck, *Dendrocygna arborea.*
Southern red-billed tree-duck, *Dendrocygna discolor.*

There remain 64 species and subspecies that occur in the United States and northward, but 11 of these are only accidental in North America. One of them, *Mareca penelope*, has been recorded about 80 times in various parts of the United States, Canada, and Greenland. *Nettion crecca* has been captured about twenty times in the same regions. *Netta rufina* has been found only once—in New York market. The other 7 occur more or less regularly in Greenland, but are not known on the mainland of North America. These 11 species are:

European Species occurring in North America as Stragglers.

European smew, *Mergus albellus.*
Widgeon,[a] *Mareca penelope.*
European teal,[a] *Nettion crecca.*
Ruddy sheldrake, *Casarca casarca.*
Rufous-crested duck, *Netta rufina.*
Velvet scoter, *Oidemia fusca.*
White-fronted goose, *Anser albifrons.*
Bean goose, *Anser fabalis.*
Brant, *Branta bernicla.*
Barnacle goose, *Branta leucopsis.*
Whooping swan, *Olor cygnus.*

Four species of eider ducks and the emperor goose are so decidedly boreal that they do not come south to the United States even in winter. These are:

Species that Breed and Winter North of the United States.

Steller eider, *Polysticta stelleri.*
Spectacled eider, *Arctonetta fischeri.*
Northern eider, *Somateria mollissima borealis* (rare on the New England coast).
Pacific eider, *Somateria v-nigra.*
Emperor goose, *Philacte canagica.* (Accidental in California.)

Deducting these, there are 54 species which regularly visit the United States during some portion of the year. Many of these, however, spend the breeding season north of the United States, and come south only in the winter season. Among these last are included both species of swans and most of the geese. Several species of ducks select Canada as their principal breeding ground, but a few individuals remain to breed in the northern part of the United States or in the mountains of the West. These are the scaup (*Aythya marila*), American golden-eye (*Clangula clangula americana*), Barrow golden-eye (*Clangula islandica*), buffle-head (*Charitonetta albeola*), harlequin duck (*Histrionicus histrionicus*), American eider (*Somateria dresseri*), and white-winged scoter (*Oidemia deglandi*). But the individuals which breed in the United States are so few—in the case of *Somateria dresseri* less than a dozen pairs—that they may be ignored in this discussion. Five other species of ducks breed entirely north of the United States, making, in all, 29 species that remain in summer north of our boundaries, as follows:

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[a] Occurs in the United States; *Netta rufina* but once.

Species that Breed chiefly North of the United States.

- Red-breasted merganser, *Merganser serrator* (rare in the northern United States).
- Red-legged duck, *Anas obscura rubripes.*
- Scaup, *Aythya marila* (rare in the northern United States).
- American golden-eye, *Clangula clangula americana* (rare in the northern United States).
- Barrow golden-eye, *Clangula islandica* (rare in the Rocky Mountains of the United States).
- Buffle-head, *Charitonetta albeola* (rare in the northern United States).
- Old-squaw, *Harelda hyemalis.*
- Harlequin duck, *Histrionicus histrionicus* (rare in the mountains of the northwestern United States).
- American eider, *Somateria dresseri* (rare in Maine).
- King eider, *Somateria spectabilis.*
- American scoter, *Oidemia americana.*
- White-winged scoter, *Oidemia deglandi* (rare in North Dakota).
- Surf scoter, *Oidemia perspicillata.*
- Lesser snow goose, *Chen hyperborea.*
- Greater snow goose, *Chen hyperborea nivalis.*
- Blue goose, *Chen cærulescens.*
- Ross goose, *Chen rossii.*
- White-fronted goose, *Anser albifrons gambeli.*
- Hutchins goose, *Branta canadensis hutchinsii.*
- Cackling goose, *Branta canadensis minima.*
- White-bellied brant, *Branta bernicla glaucogastra.*
- Black brant, *Branta nigricans.*
- Whistling swan, *Olor columbianus.*
- Trumpeter swan, *Olor buccinator* (formerly a few in the northern United States).

Species that Breed chiefly North of the Arctic Circle, with the Northernmost Latitude at which the Species has been observed in the Western Hemisphere.

- Old-squaw, *Harelda hyemalis*, 82°.
- Steller eider, *Polysticta stelleri*, 71°.
- Spectacled eider, *Arctonetta fischeri*, 71°.
- Northern eider, *Somateria mollissima borealis*, 82°.
- Pacific eider, *Somateria v-nigra*, 76°.
- King eider, *Somateria spectabilis*, 82°.
- Lesser snow goose, *Chen hyperborea*, 74°.
- Greater snow goose, *Chen hyperborea nivalis*, 72° (accidental at 82°).
- Ross snow goose, *Chen rossii*, 68°.
- American white-fronted goose, *Anser albifrons gambeli*, 71°.
- Hutchins goose, *Branta canadensis hutchinsii*, 70°.
- Cackling goose, *Branta canadensis minima*, 71°.
- White-bellied brant, *Branta bernicla glaucogastra*, 82°.
- Black brant, *Branta nigricans*, 76°.
- Whistling swan, *Olor columbianus*, 74°.

Southern Species, with Northern Limit of Breeding Range.

- Florida duck, *Anas fulvigula* (northern Florida).
- Mottled duck, *Anas fulvigula maculosa* (northern Texas; accidental in Kansas).
- Masked duck, *Nomonyx dominicus* (southern Texas).
- Black-bellied tree-duck, *Dendrocygna autumnalis* (southern Texas).
- Fulvous tree-duck, *Dendrocygna fulva* (central California).

Western Species, with Eastern Limit of Regular Range.

Cinnamon teal, *Querquedula cyanoptera* (Kansas).

Steller eider, *Polysticta stelleri* (Alaska).

Spectacled eider, *Arctonetta fischeri* (Alaska).

Pacific eider, *Somateria v-nigra* (Mackenzie).

Ross goose, *Chen rossii* (Hudson Bay).

White-cheeked goose, *Branta canadensis occidentalis* (Nevada).

Cackling goose, *Branta canadensis minima* (California).

Black brant, *Branta nigricans* (Nevada and Mackenzie).

Emperor goose, *Philacte canagica* (Alaska).

Southern Limits of Species whose Winter Range extends South of the United States.

American merganser, *Merganser americanus* (Mexico, accidental).

Red-breasted merganser, *Merganser serrator* (Mexico).

Hooded merganser, *Lophodytes cucullatus* (Mexico).

Mallard, *Anas boschas* (Panama).

Black duck, *Anas obscura* (Jamaica, accidental).

Gadwall, *Chaulelasmus streperus* (Mexico).

Baldpate, *Mareca americana* (Costa Rica).

Green-winged teal, *Nettion carolinense* (Honduras).

Blue-winged teal, *Querquedula discors* (Chile).

Cinnamon teal, *Querquedula cyanoptera* (Patagonia).

Shoveler, *Spatula clypeata* (Colombia).

Pintail, *Dafila acuta* (Panama).

Wood duck, *Aix sponsa* (Mexico).

Redhead, *Aythya americana* (Mexico).

Canvasback, *Aythya vallisneria* (Guatemala, accidental).

Scaup duck, *Aythya marila* (Bahamas).

Lesser scaup duck, *Aythya affinis* (Panama).

Ring-necked duck, *Aythya collaris* (Guatemala).

American golden-eye, *Clangula clangula americana* (Mexico).

Buffle-head, *Charitonetta albeola* (Mexico).

White-winged scoter, *Oidemia deglandi* (Mexico).

Surf scoter, *Oidemia perspicillata* (Mexico).

Ruddy duck, *Erismatura jamaicensis* (Costa Rica, accidental).

Masked duck, *Nomonyx dominicus* (Argentina).

Lesser snow goose, *Chen hyperborea* (Mexico).

American white-fronted goose, *Anser albifrons gambeli* (Mexico).

Hutchins goose, *Branta canadensis hutchinsii* (Mexico).

White-cheeked goose, *Branta canadensis occidentalis* (Mexico).

Black brant, *Branta nigricans* (Mexico).

Black-bellied tree-duck, *Dendrocygna autumnalis* (Panama).

Fulvous tree-duck, *Dendrocygna fulva* (Argentina).

Whistling swan, *Olor columbianus* (Mexico).

SUMMARY.

Species breeding regularly in the northern United States	19
Southern species ranging north to the southern United States	5
Species breeding in the United States	24
Species wintering in the United States but breeding northward	24
Species breeding or wintering in the United States	48
Species breeding and wintering north of the United States	5
Species breeding chiefly north of the Arctic Circle	15
Species breeding in the United States and northward	53
European species straggling to North America	11
Species occurring in the United States and northward	64
Southern species not ranging north to the United States	7
Total species and subspecies in North America	71

The material for determining the geographic range of the waterfowl included in this bulletin has been derived from various publications, from museum specimens, and from the notes of field agents of the Biological Survey. The data on migration are derived almost entirely from the migration schedules contributed since 1884 to this Bureau by hundreds of observers distributed throughout the United States and Canada. Opportunity is here taken to extend acknowledgments to the many whose painstaking observations for a long series of years have made possible the present publication.

DISTRIBUTION AND MIGRATION OF DUCKS.

Merganser americanus (Cass.). American Merganser.

Breeding range.—The principal breeding ground of this merganser is in southern Canada from the maritime provinces to Saskatchewan. Southward the species nests quite commonly in Maine, the colder portions of New Hampshire, and in Vermont; it probably has bred casually or accidentally in Massachusetts. It is rather common in the Adirondacks and is not rare in the lake region of northwestern New York. It formerly bred in several of the mountainous counties of central Pennsylvania (Perry, Lancaster, Clinton, and Lycoming), and may yet breed occasionally in that State and in Ohio. It breeds commonly at Ottawa and the Muskoka region in Ontario and it is not rare in the southern part of the Province and on the shores and islands of Lake Ontario. It is common in northern Michigan—rarely as far south as central Michigan—also in southwestern Minnesota (Heron Lake), South Dakota (Fort Sisseton, Black Hills), and south in the Rocky Mountains to northern New Mexico (near Santa Fe), north central Arizona (Fort Verde), and the Sierras of California.

The breeding range extends north to central Ungava (Hamilton River), Hudson Bay (York Factory), Great Slave Lake, and on the Pacific coast regularly to the Queen Charlotte Islands, and rarely to the base of the Alaskan Peninsula at about latitude 60° (Iak Lake, July 24, 1896).

Winter range.—On the Atlantic coast this duck ranges from Maine to South Carolina, rarely to Georgia and Florida; in mild winters it occurs as far north as Prince Edward Island; in the interior it winters from the Gulf of Mexico to southern Ontario, Lake Michigan, Kansas, northern Colorado, Idaho, British Columbia, and rarely to Unalaska Island and the Pribilof Islands. In winter it reaches northern Mexico and northern Lower California. It occurs occasionally in the Bermudas.

Spring migration.—Though the northward movement of this merganser begins early—late February—and there is much activity in the Mississippi Valley in March, on the Atlantic coast the advance beyond the usual winter home is comparatively late. The average date of arrival at Montreal is April 5; Ottawa, Ontario, April 16; Prince Edward Island, April 21. The first merganser was seen on Hamilton River, Ungava, May 28. At Heron Lake, Minnesota, the average date of arrival is March 26 (earliest March 17, 1886); average at Aweme, Manitoba, April 11. The larger number have left the winter range by early April; but along the middle Atlantic coast a few are seen in May, while on the Massachusetts coast nonbreeders occur all summer.

Eggs have been taken at Kingston, Ontario, April 10, 1902; at Godbout, Quebec, May 12, 1884; on Hamilton River, Ungava, June 25; eggs incubated one week, on Lake Tagish, Yukon, June 30, 1899; young in northern California May 21.

Fall migration.—A few of this species start south in August (Woods Hole, Mass., August 26, 1890), but in general the American merganser is a late migrant, passing south only when forced by winter storms. The average date of arrival on the Massachusetts coast is October 5, and on Chesapeake Bay October 15. The average date when the last are seen on Prince Edward Island is November 1; Montreal, November 6; Ottawa, Ontario, November 21.

Merganser serrator (Linn.). Red-breasted Merganser.

Breeding range.—Most of the summer home of this species in the Western Hemisphere lies north of the United States, though a few nest in Maine (Houlton, Magalloway River, Isle au Haute), and farther south on Sable Island, Nova Scotia; also in northern New York (Adirondacks), Michigan, Wisconsin (Green Bay), Minnesota (St. Paul), and probably in Oregon (Crooked River and Camp Harney). The breeding range extends far north to Greenland (Scoresby Sound, Upernavik), Cumberland Gulf, Mackenzie (Fort Anderson), Alaska (Icy Cape), and the northern coast of Siberia. The species breeds commonly on the whole western coast of Alaska, the Near Islands, the Yukon Basin, and south to southern British Columbia. It breeds commonly also in northern Europe and northern Asia, whence it retires in winter to southern Europe and central Asia.

Winter range.—A single specimen was taken near Habana, Cuba, in December, 1891, and this seems to be the only record south of the eastern United States. The species is not rare in winter in Florida and along the Gulf coast to Texas; thence it is quite rare in New Mexico and Arizona, but is common throughout the whole of California and south to Lower California (La Paz). It is common in winter on the Atlantic coast as far as Maine, and remains around the Gulf of Saint Lawrence until the bays freeze. It is not uncommon even in Greenland during the winter. In the interior it braves the winter on the Great Lakes and north to Wisconsin, Nebraska, Colorado, and Utah; north on the Pacific coast to southern British Columbia; it is casual on the Hawaiian Islands and the Bermudas.

Spring migration.--The red-breasted merganser winters so far north that few migration data are available. The species is most common on the Massachusetts coast during the first half of April, though migrants begin to pass a month earlier. The average date of arrival at Montreal is April 16 (earliest, April 6, 1894); at North River, Prince Edward Island, April 21 (earliest, April 15, 1891); Lake Mistassini, Ungava, May 11, 1895; Heron Lake, Minn., April 2, 1884, April 4, 1885; Aweme, Manitoba, April 22, 1899; Fort Keogh, Mont., April 27, 1889; Chilcat, Alaska, May 8, 1882; mouth of the Yukon about the middle of May; Kowak River, Alaska, middle of June (1899). The region in the United States to the south of the breeding ground is deserted in May, except by a few cripples and nonbreeders, some of which are present all summer on the coasts of New Jersey and New England.

Fall migration.—The first arrival in 1896 at Monterey, Cal., was noted October 9; about the same time the species appears in the corresponding latitude on the Atlantic coast. Indeed, October can be said to be the month of arrival in the winter home, and of departure from the most northern breeding grounds; the last was seen on the Mackenzie River, about latitude 63°, October 15 and 16, 1903.

Lophodytes cucullatus (Linn.). Hooded Merganser.

Breeding range.—This merganser breeds locally throughout much of North America, from Florida (Fort Myers and Titusville), Georgia, South Carolina, Tennessee, Kansas, Colorado, northern New Mexico, Nevada, and Oregon, north to Newfoundland, southern Labrador, Hudson Bay (Fort Churchill, latitude 62°), Great Slave Lake, and central British Columbia (Cariboo district). One specimen was seen at Fort Wrigley, Mackenzie River, latitude 63°, where possibly it may breed; it is accidental in Alaska (St. Michael, October, 1865), Bermudas, Europe. In the Southern States mentioned the species is quite rare and local, and the same seems to be true of all the district north of Maine and east of Ontario. The species is most common from latitude 44° to latitude 60°, between the Rocky Mountains and Lake Huron.

Winter range.—It remains during the winter rarely as far north as Massachusetts, Pennsylvania, Lake Michigan, Nebraska, Colorado, Utah, and southern British Columbia. It is more common in the central districts and Gulf States. A few migrate to Cuba, Central Mexico (Orizaba, City of Mexico), and southern Lower California.

Spring migration.—Since the hooded merganser breeds over much of its winter range, it is difficult to determine when its spring migration begins. Migratory movements occur in late February, and average dates of arrival are: Western New York, March; Montreal, early April; Ottawa, Ontario, April 18 (earliest, March 21, 1903); southern Michigan, March 19; central Iowa, March 22 (earliest, March 5, 1895);

Heron Lake, Minn., April 5 (earliest, March 20, 1889). On March 28, 1877, young, a week old, were found in central Florida. Eggs have been taken on April 20 in Illinois and on April 29 in southern Ontario.

Fall migration.—The species arrives in the valley of Mexico in October and in southern California in November. Many years' observations at Alexandria, Va., fix the average date of arrival there as October 26, and November 22 as the average date when the hooded merganser becomes common. The average date when the last left Montreal was October 29; southern Minnesota, November 10, and central Iowa, November 22.

Mergus albellus Linn. Smew.

This is an Old World duck which has been taken once as an accidental visitant to North America. The basis for its inclusion in the list is a single specimen, an adult female, now in the British Museum, which was purchased from the Hudson Bay Company (Cat. Birds Brit. Mus., XXVII, p. 468, 1895). There is no evidence as to the locality of its capture.

Anas boschas Linn. Mallard.

Breeding range.—The northern half of the United States west of Pennsylvania, and the whole of Canada west of Hudson Bay, constitute the principal breeding range in the Western Hemisphere of the mallard—the commonest duck on the North American continent and probably in the world. In eastern North America the place of the mallard is taken by the black duck, and the former is rather rare, though a few breed in eastern Ontario about Lake Erie, locally in western New York, and south to Maryland. Though unknown as a breeder on the mainland east of Hudson Bay, the mallard is rather common in Greenland, breeding north to Godthaab and Angmagsalik and wandering to Upernavik. Throughout New England and the Maritime Provinces it is a rare migrant, and while some of the records of its breeding in these districts may be correct, it is no more than a casual summer resident.

In the interior the breeding range extends regularly south to latitude 41° and a few breed south to southern Indiana, southern Illinois, central Missouri, and southern Kansas. The breeding range bends south in the Rocky Mountains to southern New Mexico and on the Pacific coast to Lower California (San Pedro Martir Mountains).

The breeding range extends north to Fort Churchill, to the Arctic coast in the Mackenzie Valley, and to Kotzebue Sound and the Fur Seal Islands in Alaska.

The mallard is one of the earliest birds to breed. The nesting season extends from early April in southern California and the first week of May in northern Indiana, to early June in the Mackenzie Valley and the Yukon Delta, and the last week of June in Greenland.

It is one of the common ducks of the Old World, breeding in the Northern Hemisphere and ranging south in winter to central Africa and southern Asia.

Winter range.—The mallard is a fresh-water duck, and in general it winters as far north as open fresh water is found. The greater number spend the winter in the southern half of the Mississippi Valley, and for many years this was the source of a large part of the market supply. The numbers killed were almost incredible. Big Lake, Arkansas, was and still is one of the favorite resorts, and during the winter of 1893–94 a single gunner sold 8,000 mallards, while the total number sent to market from this one place amounted to 120,000. Fortunately both Arkansas and Missouri now forbid market shooting, and this deplorable slaughter has been decidedly lessened.

This species winters casually in eastern Massachusetts and central New York, accidentally in Nova Scotia, and regularly from Virginia to northern Florida. It is less common in central Florida, and has been recorded in the Bermudas, Bahamas, Cuba, Jamaica, Grenada, Carriacou, Panama, and Costa Rica. Most of these localities have only one record each, showing that the mallard is only a straggler to the southeast of the United States. There seems to be no record for Central America from Costa Rica to Mexico. The species is a common winter resident of northern Mexico and ranges south to Jalapa, the Valley of Mexico, Colima, and southern Lower California.

The northern winter limit in the interior is in Ohio, northern Indiana, southern Wisconsin, Nebraska, Wyoming, and central Montana. The species is common in winter along the whole Pacific coast as far north as the Aleutian Islands.

Spring migration.—It is among the earliest of ducks to move northward and forms a large proportion of the early flocks. The portion of the central Mississippi Valley that forms the extreme winter range is invaded by the spring migrants the latter part of February; Frankfort, Ind. (average for ten years), February 21; central Illinois (twelve years), February 22; central Missouri (sixteen years), February 26; Keokuk, Iowa (nine years), February 24; southern Kansas (eleven years), February 18; southeastern Nebraska (five years), February 19. Just north of the winter range average dates of spring arrival are: Erie, Pa., March 5; central New York, March 23; Oberlin, Ohio, March 21; southern Michigan, March 9; southern Ontario, March 24; Ottawa, Ontario, March 27; Chicago, Ill. (eleven years), March 19; southern Wisconsin (twelve years), March 21; Spirit Lake, Iowa, March 10; Heron Lake, Minn., March 11; central South Dakota (fourteen years), March 16; Larimore, N. Dak. (twelve years), March 28; Terry, Mont., March 26. The mallard crosses into central Canada early in April, and the average date of arrival at Aweme, Manitoba (ten years), is April 3 (earliest March 24, 1905); Qu' Appelle, Saskatchewan (six years), April 10 (earliest, March 26, 1905). The earliest migrants were seen at Fort Resolution May 7, 1860; near Fort Providence, April 27, 1904; Fort Simpson, May 3, 1904; Kowak River, Alaska, May 17, 1899.

The last one seen in 1892 at Shellmound, Miss., was on April 5; in northern Texas one was seen as late as May 6, 1889. In central Missouri, where a few remain to breed, the average date when the last migrants are seen is March 28.

Fall migration.—In the fall this species returns with the general mass of ducks, and the average date of its arrival at Alexandria, Va., is September 21 (earliest, August 28, 1896); it becomes common October 27; at Chicago, Ill., September 27; Grinnell, Iowa, September 17; and in northern Texas October 11. The first one was noted at San Angelo, Tex., August 10, 1883, and at Austin, Tex., September 1, 1893.

The mallard is one of the moderately hardy ducks, and remains in the north until the lakes begin to freeze. Average dates when the last were seen are: Montreal, Canada, October 26 (latest, November 13, 1897); Scotch Lake, New Brunswick, November 7; Ottawa, Ontario (nine years), November 5 (latest, November 14, 1904); Aweme, Manitoba (eight years), November 12 (latest, November 23, 1902); Chicago, Ill., November 13; English Lake, Ind., December 9; southern Minnesota (ten years), November 22 (latest, December 11, 1890); central Iowa (12 years), November 15 (latest, November 27, 1903); central Nebraska, November 18 (latest, November 26, 1899).

Anas obscura Gmel. Black Duck.

Breeding range.—The group of 'black' or 'dusky' ducks comprises several species which closely resemble each other and which have been distinguished only in recent years. The black duck is the common breeding duck of New England and northern New York, south of which it breeds not rarely on Long Island and locally in Pennsylvania (Bradford County), New Jersey (Long Beach), Delaware, and Maryland (Ocean City, Barrow Springs). To the westward the breeding range extends south to Ohio (formerly), Indiana (Lake County), Illinois, Iowa (Spirit Lake), and Minnesota (Kandiyohi County). It breeds rarely and locally over much of Wisconsin, but breeds more commonly in Michigan and southern Ontario. It is a very common summer resident of Quebec, New Brunswick, Nova Scotia, and the islands of the Gulf of St. Lawrence. The most northern points at which it breeds are in southern Labrador and Newfoundland. Somewhere in Labrador and in northern Ontario this form meets the more northern form, the red-legged duck (*Anas obscura rubripes*), but the dividing line between the two is unknown. A specimen from the Straits of Belle Isle is *obscura;* one from Okak, Labrador, is intermediate, and one from Ungava Bay, only a few miles farther north, is *rubripes.*

The black duck breeds so early that young have been found at Old Saybrook, Conn., May 5, and eggs at Rehoboth, Mass., April 30.

Winter range.—This species is accidental in winter in the West Indies (Jamaica), rare in the Bermudas, and rare in central Florida (Gainesville) and also in Alabama. From Georgia northward it is more common, and from North Carolina to New Jersey it is one of the abundant winter ducks. Black ducks, including both *A. obscura* and *A. rubripes*, are abundant at this season around Long Island and on the shores of Rhode Island and Massachusetts, but although a few *A. obscura* winter in Massachusetts, the greater number are *A. rubripes.* West of the Alleghenies there is uncertainty as to which form preponderates in winter. *A. obscura* is a tolerably common winter resident of Louisiana, but *A. rubripes* reaches Arkansas, and one form or the other winters as far north as southern Ohio, southern Indiana, and southern Illinois. In migration *A. obscura* is rare west to eastern Nebraska (Fairmont, Gresham, Calhoun) and eastern Kansas (Reno County, Wichita, and Lawrence). Notes on the migration of this species are for the most part included under those of *A. rubripes.*

Anas obscura rubripes Brewst. Red-legged Black Duck.

Breeding range.—As stated under the last species, a breeding duck from Okak, northeastern Labrador, is considered intermediate between this form and *A. obscura*, while the bird breeding at Ungava Bay is *A. rubripes.* This Ungava Bay record seems to mark the northeastern limit of the species so far as reported. Thence the species extends west to Hudson Bay, as far north at least as Fort Churchill, and is rare or accidental west to Manitoba (Long Lake; Lake Manitoba, October 28, 1900; Delta, September 4, 1902, September, 1903; St. Marks, two, October, 1902), and to Fort Anderson. The southern limit of the breeding range in Ontario has not yet been determined.

Winter range.—Most of the black ducks that winter in Massachusetts are *A. rubripes*, and this is about as far north as the species commonly winters. Along the coast some have been known in winter as far north as Nova Scotia. How far south the species goes has not yet been determined, but it is common on the coast of South Carolina from November to March, and a specimen was taken in Mississippi County, Ark., November 5, 1887. It occurs west to Nebraska (Greenwood, Lincoln, Calhoun) and undoubtedly wanders to eastern Kansas. The northern winter limit in the interior is probably from northwestern Pennsylvania to southern Wisconsin.

Spring migration.—It is impossible to separate the migration records of *A. obscura* and *A. rubripes.* The following migration notes probably refer for the most part to *A. rubripes*, because that form winters farther north. In March extensive northward movements of black ducks occur, but it is not until early April that the birds pass beyond the usual winter range. The average date of arrival for seventeen years in southern Maine is April 7; the earliest, March 19, 1894; the average date for Montreal is April 14, and March 27, 1889, is the earliest; Quebec, average, April 18 (earliest, April 6, 1896); Godbout, Quebec, average, April 21; Prince Edward Island, April 23 (earliest, April 5, 1898). Farther west the average date of arrival in southern Ontario is April 7 (earliest, March 16, 1901); average at Ottawa, April 14 (earliest, March 21, 1903).

Fall migration.—A black duck was seen at Washington, D. C., August 1, 1887; one at Alexandria, Va., August 14, 1886, and one at Hog Island, Va., August 20, 1886; but these are unusually early records. The average of a long series of excellent records at Alexandria, Va., is September 30 for the arrival of the first and October 31 as the average date when they become common. About the middle of October, on the New England coast, they become common enough to usher in the shooting season. These dates, of course, apply to *A. obscura.* There are no exact records of the time when *A. rubripes* arrives from its northern breeding grounds, but it is supposed that it reaches New England about the first week in October. In winter it remains as far north as it can find open water. The average date when the last leave Ottawa, Ontario, is November 7 (latest, November 21, 1892); average at Montreal, November 6 (latest, November 14, 1896). The last one was seen at Prince Edward Island November 13, 1889, and December 8, 1890.

Anas fulvigula Ridgw. Florida Duck.

A nonmigratory species, breeding commonly in the southern half of Florida, and less commonly in the northern portion. It seems to be absent from northeastern Florida, but occurs along the northwestern coast of the State. Nests in late April and in May, but sometimes much earlier, for downy young have been taken as early as April 6.

Anas fulvigula maculosa (Senn.). Mottled Duck.

Resident in Texas and southern Louisiana (Lake Arthur). In Texas it occurs from the mouth of the Rio Grande northward and west to about the middle of the State. It is accidental in Kansas (Neosho Falls, March 11, 1876). It breeds throughout most if not all of its Texas range; the eggs are deposited in April.

[**Anas diazi** Ridgw. Diaz Black Duck.

A form of 'black duck' closely resembling *Anas fulvigula.* It is nonmigratory and occurs in central Mexico from Chihuahua City to Tepic, Jalisco, Michoacan, the Valley of Mexico, Puebla, and Tlaxcala.]

[**Anas aberti** Ridgw. Abert Duck.

A species known only from the type specimen taken at Mazatlan, Mexico.]

Chaulelasmus streperus (Linn.). Gadwall.

Breeding range.—A large majority of the North American individuals of this species breed in the prairie district extending from Manitoba to the Rocky Mountains, south to western Minnesota, and from northern South Dakota north to the Saskatchewan.

The species breeds commonly from the Rocky Mountains to the Pacific, south to southern Colorado, Utah, Nevada, and in nearly the whole of California; also probably in the Mogollon Mountains of Arizona. The northern range extends to southern British Columbia, Alberta (rarely or casually to Lesser Slave Lake), and to Fort Churchill on Hudson Bay. There is no authentic record for the Mackenzie Valley, and if the specimen in the British Museum labeled "Bering Straits" really was captured there it was a wanderer, as was also one taken at Unalaska, March 18, 1879.

In the Mississippi Valley the gadwall occasionally breeds in northern Nebraska and rarely in Kansas. Formerly it bred in Wisconsin (Horicon Marsh and Lake Koshkonong), there is one record for Ontario (St. Clair Flats), and one for Anticosti Island. It is only a straggler to New England and the Maritime Provinces north to Quebec and Newfoundland, and east of the Mississippi is rare north of North Carolina.

The gadwall is a common breeder in Europe and Asia, ranging south in winter far into Africa and to southern Asia.

Winter range.—The principal winter home of the gadwall is in the lower Mississippi Valley, especially Texas, Louisiana, and Arkansas. It rarely winters as far north as Illinois, but is more common to the eastward in North Carolina and Florida; accidental in Cuba (twice), Jamaica, and the Bermudas. The winter range extends to the southern end of Lower California, to Mazatlan, and the City of Mexico. In northern Mexico the species is common through the winter, and birds have been found paired in May, the late date indicating that they intended to remain and breed. Thence it extends commonly to Utah and Oregon, rarely to Washington and British Columbia.

Spring migration.—Only a few notes on the migration of this species have been recorded. The average date when the first spring migrants reach southern Iowa is March 18 (earliest March 10, 1896), it thus being one of the earlier ducks in this part of its range. It reached Heron Lake, Minn., April 1 (earliest March 17, 1886); Loveland, Colo., March 6, and Terry, Mont., about April 1. The first migrant was seen at Aweme, Manitoba, April 23, 1898, and at Indian Head, Saskatchewan, April 18, 1892, and April 24, 1904. Eggs have been secured at St. Clair Flats, Ontario, about May 30; in western Minnesota, June 14, 1879; northern North Dakota, June 15, 1901; Manitoba, June 5, 1894; Crane Lake, Saskatchewan, June 9, 1894; Nevada, May 29, 1868, and incubated eggs in Los Angeles County, Cal., April 16.

Fall migration.—The first arrived at the southern end of Lower California September 27, 1887; in northern New Mexico the species was abundant the last days of September, 1904. The average date when the last left central Minnesota was November 14.

Mareca penelope (Linn.). European Widgeon.

This is an Old World species which has occurred as a straggler on the Atlantic coast in Florida, North Carolina, Virginia, Maryland, Pennsylvania, New Jersey, New York, Massachusetts, Nova Scotia, Newfoundland, and Greenland; in the interior it has been found in Illinois, Indiana, Ohio, Michigan, Wisconsin, and Nebraska; on the Pacific coast in California, British Columbia, and Alaska. It is not known to breed anywhere in the Western Hemisphere.

On the Atlantic coast the dates are almost entirely in the fall and winter, from October 20 (near Halifax, Mass.) to March 25 (Keuka Lake, New York)—there are only three records after February 5—while in the interior its occurrence is as strictly confined to the spring, from March 23 (English Lake, Ind.) to April 18 (Sandusky, Ohio). The records for Greenland fall between September 29 and December 17; the California records are mostly in February, while those of British Columbia are from December 25 to February 9, and the two Alaska dates are October 12 and May 27.

Mareca americana (Gmel.). Baldpate. American Widgeon.

Breeding range.—A line drawn from the western shore of Hudson Bay to the western shore of Lake Michigan marks, approximately, the eastern boundary of the breeding range of this species, and in the eastern 200 miles of this district it is decidedly uncommon during the nesting season. There are a few records of the bird's breeding in Indiana (Hogback Lake, English Lake) and in Wisconsin (formerly at Koshkonong and Horicon), but not until Minnesota is reached does this duck breed commonly. West of the Mississippi it breeds abundantly in North Dakota, a few in southern South Dakota, and rarely or casually in Nebraska and Kansas. It is a common breeder in Colorado, Utah, and Nevada (Truckee Valley), and probably breeds rarely in Arizona (Mormon Lake), but as yet the species has not been recorded as nesting in California. The main breeding range is northwestern North America from Oregon and Minnesota north to the Mackenzie Valley and central Alaska. A line from Fort Churchill, Hudson Bay, to Franklin Bay is the approximate northeastern boundary of the range, thence west to Kotzebue Sound. If this line from Franklin Bay to Fort Churchill is continued to Chesapeake Bay, it marks the approximate eastern limits at which the species is common in migration. Northeastward the species is known as a rare migrant, in New England hardly more than a straggler, but it has been recorded as far as Newfoundland, southern Labrador (Natashquan), and northern Ontario (Moose River). The baldpate is rather rare on the coast of Alaska, but is more common in the interior, and is a rare or casual visitor to the Near, Commander, and Bermuda islands.

Winter range.—The baldpate is common on the Chesapeake in winter, but as it is rare directly to the northward at all times of the year, it is evident that the migration is from the northwest. Occasionally birds are found in winter as far north as Rhode Island. The species is common during the winter in the Carolinas, less common in Florida and Cuba, and rare in the Bermudas, the Bahamas, Jamaica, Porto Rico, St. Thomas, and Trinidad. It is recorded from Costa Rica, and is a rather common winter resident of northern Guatemala and much of Mexico north of the Valley of Mexico. The winter home in the Mississippi Valley extends north to Illinois, and in the west to New Mexico, Arizona, Utah (probably), and to southern British Columbia. It is probably most common during the winter along the Pacific coast.

Spring migration.—This begins late in February and by early March the species is north of its winter home. Average dates of arrival are: Western New York, March 23; Erie, Pa., March 24; Oberlin, Ohio, March 17; southern Michigan, March 25; Keokuk, Iowa, March 15; central Nebraska, March 17; Loveland, Colo., March 10. The further advance of the species is somewhat slow. The average time of reaching Heron Lake, Minn., is March 29; southern Manitoba, April 20; Terry, Mont., April 8. The first individual was seen at Indian Head, Saskatchewan, April 24, 1904, and at Osler, Saskatchewan, May 2, 1893. These dates indicate an average speed of 17 miles per day from central Nebraska to Heron Lake, and 18 miles per day thence to southern Manitoba. The average rate from Colorado to Montana is 16 miles per day, and the same rate continued northward would bring the first baldpate to Indian Head and Osler at almost exactly the stated dates. If the birds of the Mississippi Valley pass northwest to the Mackenzie Valley, this rate of migration would bring them to Great Slave Lake about the first week in June, whereas the first arrival at Fort Simpson, Mackenzie, was April 28, 1904; and a female was shot at Fort Resolution May 24, 1860, which contained a fully formed egg. It is evident, then, that the earliest arrivals in the Mackenzie Valley come from the southwest, where, in southern British Columbia, the species winters a thousand miles farther north than on the plains. The baldpate arrives at the mouth of the Yukon in early May, and on the Knik River, Alaska, the first bird was noted May 10, 1901. Most of the few spring records in New England are in April, two in February, but the species is apparently less common in the spring than in the fall. The last migrants usually leave Cuba late in April, though in Guatemala they have been seen as late as May.

Fall migration.—The month of September, especially the latter half, sees the arrival of the first baldpates over most of the district between the breeding grounds and Cuba and Louisiana; but these are only the advance scouts; the main body appears in the northern United States early in October, and reaches the middle Atlantic States about the middle of that month. Dates of arrival are: Middletown, R. I., September 20, 1889; East Hartford, Conn., September 29, 1888; Beaver, Pa., August 30, 1890. Stragglers have been seen in Massachusetts and in northern Pennsylvania as late as the first week in December, but most leave at least a month earlier. The average date at which the last were seen at Ottawa, Ontario, is October 27, latest November 6, 1890; at Keokuk, Iowa, November 13, latest November 18, 1892. The last was seen at Montreal September 20, 1897; Edmonton, Alberta, November 6, 1896; Kowak River, Alaska, September 20, 1898; St. Michael, Alaska, October 1.

Nettion crecca (Linn.). European Teal.

This is a widely distributed Old World species, accidental in the Western Hemisphere. It has been taken in Greenland, Labrador, Nova Scotia, Maine, Massachusetts, Connecticut, Long Island, near Washington, D. C., California, and Alaska. The dates of capture range through every month of the year, except January, August, and October; those for the United States from November to April.

Nettion carolinense (Gmel.). Green-winged Teal.

Breeding range.—A few probably have bred in the mountains of north central Pennsylvania (Lycoming County), and it has been reported as nesting near Buffalo, N. Y. The regular breeding range extends from New Brunswick, through northeastern Quebec and Newfoundland, to Ungava Bay, Labrador, latitude 58°. It is a common migrant in Ontario, and hence undoubtedly breeds in the northern part. It has been recorded as a rare breeder in southern Ontario (Toronto, Point aux Pins, Oshawa, Gravenhurst). The southern boundary of the breeding range to the westward is found in Illinois (Rockford, Lacon, Fernwood), in Michigan (Neebish Island), Wisconsin (Lake Koshkonong, formerly), Minnesota (Faribault, Heron Lake), Nebraska (Dewey Lake, Badger, Valentine), Colorado (Beloit, San Luis Valley), New Mexico (San Miguel County), Utah (Salt Lake), Nevada (Washoe Lake), Oregon (Fort Klamath). The range extends north to the edge of the Barren Grounds from near Fort Churchill, Hudson Bay, to Fort Anderson, to Kotzebue Sound, and nearly to Point Barrow. It breeds throughout the Aleutian Chain to the Near Islands. It is rare as a breeder everywhere in the United States east of the Rocky Mountains, and the main breeding grounds are in west central Canada from Manitoba to Lake Athabasca. It has wandered a few times to the west coast of Greenland, from Nanortalik to Disco Bay, and was once taken in May on the east coast at Nanusek. The species is accidental in Great Britain, the Bermudas, and Hawaii.

Winter range.—South of the United States it is common in Mexico, at least as far as Jalapa, the City of Mexico, Michoacan, and Jalisco; common also in the Bahamas, and rare in Cuba, Jamaica, and Honduras. It has been recorded on the islands of Carriacou, Grenada, and Tobago, of the Lesser Antilles.

It is one of the most abundant ducks throughout the southwestern United States during winter. It is a hardy duck, and in general remains as far north as it can find open fresh water. Thus it winters in western Montana (Great Falls), central Utah, southern Nebraska, southern Iowa, central Illinois, central Indiana (rarely Lake Michigan), western New York, and Rhode Island. It is accidental in Massachusetts in winter, and one was found at Halifax, Nova Scotia, January 14, 1890. The principal winter home in the Mississippi Valley lies south of 37° latitude.

Spring migration.—The green-winged teal is one of the early migrating 'river ducks,' but not quite so early, by about five days, as the mallard. Along the Atlantic slope it passes north of its winter home in early March, and the average date of its arrival in southern Pennsylvania is March 16; southern Connecticut, April 6; Montreal, Canada, April 27, Prince Edward Island, April 26.

The average date of the first arrivals in central Missouri is February 26; central Illinois, March 7; English Lake, Ind., March 15; Keokuk, Iowa (average for twelve years), March 3; central Iowa (fourteen years), March 11; Heron Lake, Minn. (six years), March 24 (earliest March 6, 1887). In its migration along the eastern border of the Plains the green-winged teal is noted at Onaga, Kans., March 8; northern Nebraska, March 12; central South Dakota, March 20; northern North Dakota, April 6; Aweme, Manitoba, April 16, and southern Saskatchewan, April 19. These dates indicate the rather slow rate of only 18 miles a day. The average of five years' records of arrival at Terry, Mont., is March 23, a date about ten days earlier than that at which the species appears in the same latitude in Minnesota. Its winter home on the Pacific coast extends 1,500 miles farther north than on the Atlantic, and hence it is not surprising that the bird has been seen on the middle Yukon by May 3 and at the mouth of the Yukon by May 10.

South of the breeding range the last green-winged teal was seen at Raleigh, N. C., April 13, 1900; Hester, La., April 6, 1902; northern Texas, April 16, 1886. The average date of disappearance for eight years at Keokuk, Iowa, is April 7, latest, April 30, 1892.

Eggs were taken at Nulato, Alaska, latitude 65°, May 20, and no earlier date seems to be recorded for the regions to the south. Eggs have been found at Edmonton, Alberta, latitude 54°, May 27, and in southern Ontario, latitude 45°, May 22. Downy young were seen in the Devils Lake region of North Dakota June 20.

Fall migration.—An average date for the reappearance of the green-winged teal at Erie, Pa., is September 15 (earliest, September 1, 1894); at Alexandria, Va., September 29 (earliest, September 22); but it is not considered common until early November. Corresponding dates of arrival are: Keokuk, Iowa, September 21; central Kansas, September 12; central Texas, September 22; central California, September 17. The last was noted on Prince Edward Island, November 4, 1890; Montreal, Canada, November 1, 1893; Aweme, Manitoba, October 30, 1896; Kowak River, Alaska, September 3, 1898; St. Michael, Alaska, the first week in October. The average date of the last seen in southern Ontario (thirteen years) is October 28 (latest, November 7, 1890); at Keokuk, Iowa (seven years), November 22 (latest, November 27, 1902).

Querquedula discors (Linn.). Blue-winged Teal.

Breeding range.—The principal summer home of this teal is the interior of North America between the Rocky Mountains and the Great Lakes, from Northern Illinois and central Iowa north to Saskatchewan. The species is not common east of the Allegheny Mountains nor on the Pacific slope. It has been recorded as breeding rarely in Rhode Island (Sakonnet, 1890), Maine (Calais), New Brunswick (Kings County, St. John County), Nova Scotia, Anticosti Island and Newfoundland, Quebec (Montreal, Point de Monts), Ungava (Clearwater Lake, latitude 57°), rare in southern Ontario (Toronto), New York (Utica, Auburn, Buffalo, formerly Long Island, Black Pond, Ulster County). It breeds as far south as northern Ohio (Port Clinton, Sandusky), southern Indiana (Gibson County and Wheatland), southern Illinois (Anna), central Missouri (Kings Lake, Warrensburg, Kansas City), central Kansas (Emporia, Wichita, Medicine Lodge, Fort Hays)—casual or accidental breeding at Fort Reno, Okla., and San Antonio and Spring Lake, Texas—southern Colorado (Fort Garland and La Plata County), New Mexico (Santa Rosa; Black Lake, Colfax County; Chloride), probably in Arizona (Mogollon Mountains), central Utah (Thistle Valley, Fairfield), northern Nevada (Truckee Valley, Washoe Lake), and central Oregon (Burns).

The breeding range extends north to central British Columbia (Lac la Hache, 158-Mile House); but the bird is rare or accidental in Alaska (Cape Romanzoff), Alberta (Edmonton), and on Great Slave Lake. Much remains to be learned in regard to the nesting of the blue-winged teal in the West Indies and Central America. It breeds in Jamaica and in the Lesser Antilles, quite probably also in Honduras and in western Mexico (Mazatlan), near the southern end of Lower California.

The resident teal of Jamaica probably should be separated subspecifically as *Querquedula discors inornata* (Gosse), but the eastern and western boundaries of this form remain to be determined.

Winter range.—Blue-winged teal migrate over a vast extent of territory, and are found in winter throughout northern South America south to Brazil, Ecuador, Peru, and Chile. They occur abundantly in Central America, Mexico, and the West Indies, and are equally common during the winter in the Gulf States and north to North Carolina. In the Mississippi Valley few remain much north of the Gulf, though these few are scattered widely as far as southern Indiana and southern Illinois; a few winter in Arizona, and the small number of Pacific coast birds spend the winter in California and north to southern British Columbia.

North of North Carolina this teal can hardly be called a common winter species, though it is not rare on Chesapeake Bay and winters even as far north as Delaware. This species is one of the least hardy of our ducks, and few individuals remain where there is cold and ice.

Spring migration.—The blue-winged teal is among the latest ducks to migrate. The first was noted at Erie, Pa., March 27, 1898; Templeton, Mass., April 1, 1898; Prince Edward Island, April 20, 1888. In central Iowa, where the hardy ducks appear in February, the blue-winged teal was noted on the average (ten years) March 26 (earliest, March 18, 1899); northern Iowa, April 4, and Heron Lake, Minn., April 9. The records of Heron Lake are quite uniform—April 11, 1885; April 11, 1886; April 10, 1887; April 8, 1888; April 9, 1889; April 7, 1890. These dates indicate less variation in the time of arrival of this species than of any other. The blue-winged teal appears in southeastern Nebraska, March 28; central South Dakota, April 2; central North Dakota, April 12; northwestern Minnesota, April 23; Aweme, Manitoba, April 27.

In southern Texas this teal becomes common in spring about the middle of March; about the first week in April is the height of the shooting season in southern Louisiana. The latest migrants have been noted at Gainesville, Fla., April 29, 1887; Baltimore, Md., May 7, 1890; New Orleans, La., May 21, 1898; San Antonio, Tex., May 14, 1902. Eggs have been taken at Canton, Ill., May 16, 1897. Eggs just hatching were found on the Magdalen Islands, Gulf of St. Lawrence, June 16, 1900, and fresh eggs at Waseca, Minn., June 1; in North Dakota, June 12; and at Reaburn, Manitoba, June 4, 1894.

Fall migration.—The blue-winged teal is one of the earliest ducks to move southward; during the month of August it reappears throughout the northern half of the United States and some especially early birds almost reach the Gulf of Mexico. During a period of fourteen years the average date of arrival at Alexandria, Va., was August 31 (earliest, August 18, 1889); they became common on the average September 23, though in the fall of 1887 they were already numerous September 10. The average date of arrival in central Kansas is September 12, and in southern Mississippi, September 16.

The average date at which the last was seen at Montreal was September 25; latest, September 29, 1888; the last one seen on Prince Edward Island in this same year was October 8; Lewiston, Me., November 7, 1901; Cape May, N. J., December 5, 1884.

The average date for eight years when the last one was seen at Ottawa, Ontario, is October 13 (latest, October 27, 1894); Chicago, Ill., October 18 (latest, October 22, 1904); southern Iowa, October 22 (latest, November 4, 1885); central South Dakota, October 7; eastern Nebraska, November 11; central Missouri, November 6 (latest, November 13, 1902). The last one seen in 1896 at Aweme, Manitoba, was on October 30. During the fall migration the blue-winged teal is fairly common on the Bermudas, but it rarely occurs there in spring.

Querquedula cyanoptera (Vieill.). Cinnamon Teal.

Breeding range.—The breeding range of the cinnamon teal differs essentially from that of almost every other duck in the Western Hemisphere. It consists of a large area north of the equator and a similar district south of the equator, and these two homes are separated by a strip about 2,000 miles wide, in which the species is practically unknown. In North America the breeding range extends north to southern British Columbia (Lac la Hache) and southwestern Alberta; east to eastern Wyoming (Lake Como, Cheyenne), western Kansas (Fort Wallace, Meade County); south to northern Lower California (La Grulla, San Rafael Valley, and possibly San Jose del Cabo), northern Mexico (Chihuahua City), southern New Mexico (Carlsbad), and southwestern Texas (Marathon, Rock Spring).

The cinnamon teal occurs sparingly in migration as far east as Houston, Tex., and Omaha, Nebr. It has been noted as accidental at Oak Lake, Manitoba; Big Stone Lake, Minnesota; Lake Koshkonong, Wisconsin; Licking County Reservoir, Ohio; Seneca River and Seneca Lake, New York; Lake Pontchartrain, Lake Cattawatchie, St. Malo, and Opelousas, Louisiana; Mount Pleasant, S. C.; Lake Iamonia and Key West, Florida.

Throughout this breeding area the eggs are deposited during May and June. About six months later the South American colony breeds. The breeding range includes the pampas of Argentina as far north as Buenos Aires, while in the Andes it extends north to central Peru (Santa Luzia). Southward the species breeds as far as the Falkland Islands and the Straits of Magellan. These South American breeders, of course, are not the same birds which nest in North America, for it is true, without exception, that no bird which breeds north of the equator breeds also in the Southern Hemisphere.

Winter range.—The cinnamon teal of North America retires in winter but little south of its breeding range in Mexico as far as Mazatlan, Guanajuato, and the Laguna de Chapulco, Puebla. It is found at this season as far north as Brownsville, Tex., central New Mexico, southern Arizona, and Tulare Lake, California. South of Mexico the only record is of an accidental occurrence in Costa Rica. There is no reliable record as yet for the West Indies.

During the winter season the cinnamon teal of the Southern Hemisphere has been noted as far south as the mouth of the Senger River, in Patagonia, latitude 44° S., and Chiloe Island, Chile, in nearly the same latitude. The northern range in winter is not determinable with exactness from present data. The species passes north to Rio Grande do Sul, Brazil, and to southern Paraguay. It has been noted at Chorillos and Tungasuca, Peru; near Quito, Ecuador; at Bogota and Santa Marta, Colombia. These Ecuador and Colombia teal may be accidental occurrences; it is significant, at least, that all the specimens from Colombia were taken a half a century ago, and the species has not been noted there by recent collectors.

Spring migration.—The northward movement of the cinnamon teal in the United States begins about the 1st of March, and arrivals have been noted at Ash Meadows, Nevada, March 18, 1891; Grangeville, Idaho, April 11, 1887; Chilliwack, British Columbia, April 24, 1888, and April 22, 1889; Beloit, Colo., March 23, 1892; Colorado Springs, April 9, 1882; Loveland, Colo., April 13, 1890; Lay, Colo., April 20, 1890; Omaha, Nebr., April 10, 1896, and April 12, 1897; Lake Como, Wyoming, about May 5.

Fall migration.—Southward migration occurs chiefly in September, and the northern portion of the breeding grounds from British Columbia to eastern Colorado is deserted about the middle of October.

Migration in South America.—The cinnamon teal of South America is migratory in at least part of its range, for in central Argentina it is abundant during the winter season, April to September, and rare or lacking during the breeding period. The species is migratory also in the southern portion of its range in Chile. In northern Chile and in Peru migration records are wanting. The time and direction of the migration of this species in South America correspond closely with those in the United States, but of course the breeding and wintering seasons are reversed, since they are on opposite sides of the equator.

Thus the cinnamon teal is distributed in two distinct colonies, part of the individuals breeding far north of the equator, and the rest about an equal distance to the south. The northern breeders migrate south after nesting, and the southern breeders migrate north. Whether or not the members of these two groups now represent subspecies, they are so much alike as to indicate a common origin and a former continuous breeding range. Whether isolation was gradual or was effected rapidly it is impossible to say, nor do we know the cause.

Casarca casarca (Linn.). Ruddy Sheldrake.

This is a European, African, and Asiatic species that has been taken several times in western and northern Greenland.

Spatula clypeata (Linn.). Shoveler.

Breeding range.—The principal North American summer home of the shoveler is in the prairie region of the interior, from a little south of the Canadian border, north to the Saskatchewan. Throughout this region it is common. To the eastward it is rare. It is scarcely common as far as Hudson Bay; nor is it common east of a line from southeastern Michigan to the mouth of Chesapeake Bay, in which latter region it is found only in migration and in winter. In the maritime provinces of Canada, and even north to Newfoundland, the shoveler has been recorded as a rare or casual visitor; but reliable breeding records from this region seem to be lacking. It is rare as a breeder in southern Michigan, and to the eastward is almost accidental in summer, though it has been known to breed at English Lake, northwestern Indiana, and at Long Point, on the north shore of Lake Erie. The regular breeding range extends south to northern Iowa and southern South Dakota; thence southward it breeds rarely and locally in Nebraska and Kansas, and during the summer of 1905 one of the parties of the Biological Survey found it breeding near East Bernard, about latitude 29° 30′, in southeastern Texas. In the western United States the species breeds commonly from Colorado to northern California, and rarely in New Mexico (Santa Rosa), Arizona (Mogollon Mountains), and southern California (Los Angeles County). On the southern coast of Texas the species is not uncommon all summer, though these summer residents are probably nonbreeders. Mated birds have been found in May in northern Chihuahua, Mexico, and at the southern end of Lower California, and it is not improbable that the species may breed locally in these districts, and even south to Lake Chapala, Jalisco.

The northern limit of the usual breeding range is from the valley of the Saskatchewan to central British Columbia. The species is a rare breeder thence northward to the edge of the Barren Grounds, casually to Fort Anderson and Fort McPherson. It is rather rare in the Yukon region, but has been known to breed at Fort Yukon, Nulato, and along the west coast of Alaska from the mouth of the Kuskokwim River to Kotzebue Sound. The shoveler has a wide range in the Eastern Hemisphere, breeding north about to the Arctic Circle, and retiring in winter to northern Africa and southern Asia.

Winter range.—A few pass south in winter to Colombia, South America (Medellin, Bogota), Panama, Costa Rica, and through the West Indies (Cuba, Jamaica, Porto Rico, St. Thomas, Barbados, and Trinidad). It is rare in Florida, and seems not to have been noted in the

Bahamas. The Carolinas are the only place on the Atlantic coast where the species is common. It is not rare in Maryland, and there are a few winter records for New Jersey. The greater portion of the species winters in the southern Mississippi Valley, north rarely to southern Illinois—accidental January 11, 1892, at Lanesboro, Minn.—and south through Mexico to central Guatemala; indeed many hundreds of thousands are said to winter near Lake Chapala, Jalisco. At this season it is found in New Mexico, Arizona, all of California, and less commonly north on the Pacific coast to southern British Columbia. Numbers winter in the Hawaiian Islands. During flight between the winter and summer home it passes through the northeastern United States, not rarely through Pennsylvania and New York, and formerly it was not rare in Massachusetts; but for the last fifteen years there has been hardly more than a single record a year for the whole of New England.

Spring migration.—Records of the movements of this species are not numerous enough to permit exact statements. Migration begins late in February, but is slight before the middle of March, at which time the species begins to appear north of its winter range. Average dates of arrival are: Central Illinois, March 23; central Iowa, March 23 (average of sixteen years); Heron Lake, Minn., March 26; central Nebraska, March 25; central Colorado, March 12; vicinity of Chicago, Ill., April 16; southeastern Minnesota, April 9; central North Dakota, April 13; southern Manitoba (twelve years), April 21; Terry, Mont., April 13. The first were seen near Edmonton, Alberta, May 1, 1901; Fort Chipewyan, Mackenzie, May 7, 1893; Fort Resolution, Mackenzie, May 18, 1860, and at the mouth of the Yukon River the second week in May. The general time of breeding can be learned from the following dates: Haywards, Cal., eggs April 25, 1901; East Bernard, Tex., downy young May 14, 1905; Fort Snelling, Minn., eggs May 23; North Dakota, incubated eggs June 7; Oak Lake, Manitoba, eggs May 24, 1892.

Fall migration.—An individual seen at Erie, Pa., September 6, 1893, marks about the beginning of fall migration, and soon after this, by the middle of the month, the earliest migrants have reached the mouth of the Mississippi River. The larger portion has departed from the northern United States by the middle of October, and the region just north of the winter range is deserted early in November. South of the United States, at the southern end of Lower California, the first arrivals have been recorded October 18; Guaymas, Mexico, November; Panama, October 16; Cuba, September; Jamaica, November; Trinidad, December.

Dafila acuta (Linn.). Pintail.

Breeding range.—This is a common breeding duck throughout a wide stretch of country from North Dakota to the Arctic Ocean and

Alaska. The western shores of Hudson Bay seem to be the eastern limit of the normal breeding ground in North America. A few birds have been seen in Labrador, north to Ungava Bay, on the west coast of Greenland, north to Upernavik, and also in Newfoundland and the Maritime Provinces. But there are only a few breeding records east of the line from the western side of Hudson Bay to the western shore of Lake Michigan; examples are: St. George Island, James Bay; St. Clair Flats, Ontario, and the north shore of Lake Erie. Breeding abundantly along the northern border of the United States from Lake Superior nearly to the Pacific Ocean, the species decreases in numbers southward until it is rare or casual as a breeder in southern Wisconsin, northern Illinois (Will, Calumet Marsh, Grass Lake); southern Minnesota (Faribault, Waverly, Heron Lake); northern Iowa (Hancock County); southern South Dakota (Vermilion, Scotland, Running Water), and northern Nebraska (Kennedy, Hay Lake); accidental near Kansas City, Mo.; abundant in Montana and rare in Wyoming (Lake Desmet), Colorado (Larimer County), and probably Arizona (Mormon Lake); common in British Columbia, and rare and local through Washington (Mabton) and Oregon (Rock Creek Sink) to southern California (Alamitos). The northern limit of the breeding range extends from the Arctic coast northwest of Hudson Bay west to Alaska and the Siberian coast.

The pintail breeds in the northern portions of the Old World and migrates south in winter to northern Africa and southern Asia. A few have been taken in the Bermudas in the fall and winter.

Winter range.—The pintail is common in winter on the coast of North Carolina, and is not uncommon coastwise as far south as Florida; many spend the winter in Cuba, a few pass to Jamaica, and there is one record of the species in Porto Rico; it is one of the common winter ducks from Mexico to Costa Rica, rare in Panama; a few winter as far north as Pennsylvania and New Jersey, while accidentals in winter have been recorded from Long Island and Lynn, Mass. Only a few winter in the Mississippi Valley north of southern Illinois, and thence the winter home extends through Texas, New Mexico, and Arizona to the Pacific coast, where it is abundant at this season as far north as southern British Columbia. The species winters casually in southern Ohio and southern Indiana, while of late years it has become a regular local winter resident in southern Wisconsin.

Spring migration.—The pintail vies with the mallard in the earliness of its spring movements; these two, with the Canada goose, are among the first of the waterfowl to wing their way northward. Even in February, while winter still holds sway, restless adventurers appear in much of the region, which, except in a few favored spots, forbids residence through the winter. The average date of arrival of these birds in central Indiana (fourteen years) is February 21; southern

Illinois (twelve years), February 26; central Missouri (fourteen years), February 26; Keokuk, Iowa (fourteen years), February 18; central Kansas (seven years), February 21; southern Nebraska (five years), February 23. Farther north average dates of arrival are Erie, Pa., March 11 (earliest February 23, 1891); northwestern New York, March 25 (earliest February 25, 1902); southern Ontario, April 18; Ottawa, Ontario, April 30; Montreal, April 23; Prince Edward Island, April 24. The late arrival of this species in eastern Canada is noteworthy, for by the time it reaches there, late April, in the interior it has penetrated a thousand miles farther north. Along this latter route average dates of appearance are southern Michigan, March 18; vicinity of Chicago (thirteen years), March 20 (earliest March 12, 1893). The normal time of arrival in central Iowa, as deduced from copious records for twenty years, seems to be March 6, but in twelve of these years one station or another reported unusually early birds, the average date of arrival of which is February 21. The average date when southern Minnesota is reached is (fourteen years) March 9 and northwestern Minnesota (four years) April 8. On the plains the average dates are, northern Nebraska, March 5; southern South Dakota, March 8; central South Dakota, March 17; Larimore, N. Dak., April 3 (earliest March 20, 1889); Reaburn, Manitoba, April 8 (earliest April 5, 1900); Qu'Appelle, Saskatchewan, April 10 (earliest March 25, 1905); Great Slave Lake, Mackenzie, about May 1; Fort Confidence, May 22, 1849. A very early bird was seen at Fort Simpson, Mackenzie, April 28, 1904. Nearer the Rocky Mountains, the average date at Terry, Mont., was April 1 (earliest March 10, 1902); Great Falls, Mont., March 16 (earliest March 10, 1889); Edmonton, Alberta, April 7, 1887; St. Michael and Nulato, Alaska, about May 1; Kowak River, Alaska, May 14, 1899; Point Barrow, Alaska, June 18, 1882.

The pintail not only migrates early, but it is also among the earlier ducks to breed, as evidenced by the following data: Will, Ill., eggs, May 10, 1877; Calumet Marsh, Illinois, fresh eggs, May 29, 1875; Hancock County, Iowa, eggs, May 1, 1879; Hay Lake, Nebraska, half-grown young, June 17, 1902; North Dakota, eggs, early May, young, first week of June; Oak Lake, Manitoba, incubated eggs, May 24, 1892; near Lake Athabasca, eggs nearly hatched, June 8, 1901; Nulato, Alaska, beginning to breed May 20; Circle City, Alaska, downy young, July 10, 1903; Kowak River, Alaska, first eggs, June 1, 1899.

Fall migration.—As is true of most ducks, there is a southward movement in August, but it is not until early September that many appear south of the breeding grounds, and in the course of two weeks a few birds find their way even to the Gulf of Mexico, arriving there by the middle of September. Some early dates are: Erie, Pa., September 6, 1893; Alexandria, Va., September 13, 1890; Long

Island, September 15, 1903; Rhode Island, September 4; eastern Massachusetts, September 11; Montreal, September 3. The main flight is a whole month later, bringing the birds in large numbers to Chesapeake Bay the middle of October and to the coast of North Carolina late in that month. Some very early migrants have been seen in west central Texas September 4; at Corpus Christi, Tex., August 18, 1902, and at the southern end of Lower California, August 29. The last ones leave the Arctic just about the time the first reach the Gulf of Mexico; the last were noted at Point Barrow, Alaska, September 7, 1882; Kowak River, Alaska, September 14, 1898; St. Michael, Alaska, October 10; Fort Franklin, Mackenzie, September 27, 1903. Large flocks begin to leave southern Minnesota the middle of October, and most have departed by the first of November.

[**Pœcilonetta bahamensis** (Linn.). Bahama Duck.

This duck is among the species that range most widely in the Western Hemisphere. It is strange that it should not have been detected in Florida, for it occurs throughout the Bahamas, even in the most northern islands. Thence it ranges through the Greater and the Lesser Antilles to South America. In Brazil it is one of the most abundant ducks and occurs in decreasing numbers even south to the Falkland Islands. It has been recorded from every country of South America except Colombia, Venezuela, and Ecuador. It breeds throughout its range from the Bahamas to the Falklands.]

Aix sponsa (Linn.). Wood Duck.

Breeding range.—The wood duck is more closely confined to the United States than any other North American duck. South of this country it is not a rare resident in Cuba and is accidental in Jamaica and the Bermudas. It occurs in California south to Los Angeles and Ventura counties, in the latter of which it breeds. There is a single record for Mexico, at Mazatlan. It breeds in eastern Texas, south rarely to San Antonio; thence to the Pacific slope and north throughout the whole Rocky Mountain region it is rare or accidental. It is recorded as breeding in southwestern Colorado (Fort Lewis), northern Idaho (Fort Sherman), northern Montana (Flathead Lake), and as a rare migrant in various localities south to New Mexico and Arizona.

The northern extension of its range is found in Nova Scotia and New Brunswick, for the species is not yet recorded from Newfoundland, and there seems to be no reliable record for Labrador. It ranges at least as far north as Montreal, Ottawa, Moose Factory, Trout Lake, and Cumberland House. It appears to be absent from the Rocky Mountain region of Canada, but occurs in southern British Columbia (Agassiz, Sumas, Chilliwack, and Burnaby Lake).

It is one of the earliest ducks to breed, as young were found in northern Florida on March 19, 1877.

Winter range.—The southern range in winter has already been given; northward the species winters regularly to North Carolina, occasionally in Maryland and Pennsylvania; accidentally in New York and Massachusetts. In the interior it is found at this season as far north as southern Indiana, southern Illinois, and Kansas. On the Pacific coast a few winter near the northern limit of the summer range.

Spring migration.—This duck is one of those which migrate north moderately early, and in central New York the average date of its arrival is March 25 (earliest March 16, 1898); eastern Massachusetts, March 24; Montreal, Canada, April 24; central Iowa, March 20 (earliest March 7, 1898); northern Ohio April 1 (earliest March 10, 1887); Petersburg, Mich., March 15; southern Ontario, April 17 (earliest April 1, 1890); Ottawa, Ontario (average fifteen years), April 22 (earliest March 26, 1898); Heron Lake, Minn., April 4 (earliest March 24, 1890); Elk River, Minn., April 6 (earliest April 4, 1885); southern Manitoba, April 15 (earliest April 2, 1895.)

Fall migration.—The southward migration amounts to no more than withdrawal from the northern half of the summer range. This occurs largely during October, and the average date when the last migrants are seen at Ottawa, Ontario (fourteen years), is October 27 (latest November 7, 1896); Montreal, November 1; southern Maine, October 27 (latest November 2, 1896); southern Iowa, November 9 (latest November 21.)

[**Cairina moschata** (Linn.). Muscovy Duck.

In its domesticated form this duck is well known throughout the civilized world. In its wild state it is an abundant inhabitant of Middle and South America from Tampico, Yucatan, Mazatlan, and the Rio Zacatula in Mexico to central Argentina. There is no certain record of its occurrence in the United States nor in the West Indies, although a supposed hybrid between the muscovy and the mallard was described from Jamaica under the name of *Anas maxima*, and similar birds have been taken several times along the Atlantic coast of the United States. Probably all these escaped from domestication.]

Netta rufina (Pall.). Rufous-crested Duck.

This is a European and Asiatic species, one specimen of which was found in 1872 in the New York City market.

Aythya americana (Eyt.). Redhead.

Breeding range.—The greater number of redheads summer in a rather restricted area in western central Canada, comprising western Manitoba, Alberta, and Saskatchewan. The species breeds not rarely in the northern portions of Minnesota, North Dakota, and Montana. It is less common in southern Minnesota (Madison, Heron Lake), southern South Dakota (Harrison, Vermilion), Idaho (Lake Hoodoo), and on the Pacific slope locally from Lac la Hache, British Columbia, south to southern California (Ventura and Los Angeles counties), and east to Ruby Lake, Nevada, and Rush Lake, Utah. The redhead used to breed not uncommonly in the great marshes of the lake region of southeastern Wisconsin, but now it is restricted to a few localities, one of which is Lake Koshkonong. It has bred on the St. Clair Flats of Michigan and Ontario.

Only a few pass as far north as 54° latitude, the northern range of the species thus being more restricted than that of any other Canadian duck. A stray was taken in 1896 on Kadiak Island, Alaska, the only record on the Pacific coast north of Vancouver Island, and an individual was taken in the fall in southeastern Labrador. It is not yet recorded in Newfoundland, and is a rare migrant in the Maritime Provinces.

Winter range.—The principal winter home of the redhead is from Texas, along the Gulf and Atlantic coasts, to Chesapeake Bay; a few winter on Long Island, and a still smaller number around Cape Cod and Lakes Ontario and Erie; the species winters in the Mississippi Valley north to Illinois and Kansas, and in the West to New Mexico, Arizona—rarely Utah—Nevada, and southern British Columbia, almost as far north as it breeds. The redhead is not uncommon in winter in the Valley of Mexico, but is quite rare on the west coast south to Manzanillo and southern Lower California. It is accidental in Jamaica.

Spring migration.—The redhead moves north with the great body of river ducks soon after the first open water appears. Average dates of arrival are: Oberlin, Ohio, March 10 (earliest March 4, 1904); central Indiana, March 13 (earliest March 6, 1887); southern Ontario, March 24 (earliest March 14, 1898); Keokuk, Iowa, March 7 (earliest February 13, 1898); central Iowa, March 18 (earliest, March 8, 1887); southern Wisconsin, March 30 (earliest March 10, 1898); Heron Lake, Minn., March 26; central Nebraska, March 10 (earliest February 10, 1896); northern Montana, April 13 (earliest April 7, 1895); southern Manitoba, April 21 (earliest April 12, 1903). Eggs have been found in southern California in May; at Horicon Lake, Wisconsin, May 24; in northern North Dakota, June 1; at Rush Lake, Saskatchewan, June 15.

Fall migration.—The movement of the redhead exhibits in extreme degree a phase of migration, shared to a lesser extent by several other species, in which the course taken is at a wide angle from the normal southern one. Lake Winnipeg marks the extreme northeastern part of the district where it breeds commonly, and yet the species is a fairly common fall migrant along the Atlantic coast from Cape Cod southward. The individuals that visit Cape Cod take an almost eastern course, or at least go 3 miles east for every mile south. From the nearest breeding grounds to the lower Hudson Valley, which is about as far north as the species occurs regularly in large numbers, the course is almost at right angles to the general trend of the Atlantic coast line. In other words, this is the course the redhead should take to reach salt water by the shortest route. This route from Manitoba to Long Island is through a district abounding in shallow lakes and marshes, which furnish abundant food. After reaching the coast, most of the redheads pass southward and winter from Chesapeake Bay to Florida and the Bahamas. Only a portion of the species, however, takes this east and west course. Many flocks pass directly south and are common all through the Mississippi Valley to the Gulf coast and through Texas to central Mexico. The average date when the first migrants appear in southern Ontario is September 19 (earliest September 10, 1896); at Erie, Pa., the average date is October 7, while at Alexandria, Va., a long series of careful records fixes October 12 as the average date of arrival—October 5 (1901) the earliest—and October 29 as the average date when the species becomes common. In general it may be said that the large flocks cross into North Dakota about the 1st of October, are common in the central Mississippi Valley about the middle of the month, and reach the Gulf coast, from Texas to Florida, early in November, when the last are deserting the northern breeding grounds.

A single individual was seen in southeastern Labrador, September 23, and this bird must have journeyed nearly 2,000 miles in a due easterly direction.

Aythya vallisneria (Wils.). Canvasback.

Breeding range.—The district just east of the Rocky Mountains in Alberta seems to be a center of abundance of this species in the breeding season. East of this district it breeds commonly to about the one hundredth meridian; south to the southern boundary of Canada, west to central British Columbia and Sitka, north to Great Slave Lake, and northwest to Gens de large Mountains and Fort Yukon. It does not commonly breed in the United States, but a few nest in northern North Dakota and in diminishing numbers southward to Nebraska (Cody, Irwin, Hackberry Lake); it is rare as a breeder in Minnesota (Madison, Heron Lake), and a few crippled birds have been known to breed on Lake Koshkonong, Wisconsin. In 1900 it bred casually at Barr Lake, near Denver, Colo., and it has been known to breed at Pyramid Lake, Nevada, and in a few places in Oregon.

Winter range.—The statements of the breeding range just made show that the eastern edge of the regular summer home is more than a thousand miles west of Chesapeake Bay, which, until a comparatively recent period, was a favorite winter home for the canvasback. The line of the Great Lakes seems to be the general route followed in this southeastward migration, and a few canvasbacks stop for the winter as far north as Lake Erie and western New York. To the northward of Chesapeake Bay the numbers decrease rapidly until Long Island is reached, where the bird is rare. It is hardly more than a straggler in Massachusetts and is accidental in Maine, New Brunswick, and Nova Scotia. It has not been recorded as yet from Newfoundland, Labrador, or the Hudson Bay region.

The great flocks that formerly covered Chesapeake Bay are of the past, but a few still winter on the coast of the Carolinas. Accidentals are recorded from the Bermudas, from Cuba and Jamaica, and one from Guatemala. These seem to be all the records south of the Valley of Mexico, where it is not rare in winter. The winter range extends from this district and Mazatlan on the western coast, north to southern Illinois, Colorado, Nevada, and southern British Columbia.

Spring migration.—In February a few move north, bringing the van the latter part of that month to about latitude 39° in the Mississippi Valley, which is the northern limit of the species in mild winters. Early March brings the species to southern Iowa. Average dates of spring arrival are: Keokuk, Iowa, March 12; central Iowa, March 15; southern Wisconsin, March 26; Heron Lake, Minn., March 28 (earliest March 19, 1889); central Nebraska, March 14; northern North Dakota, April 18; southern Manitoba, April 21 (earliest April 6, 1885). In the interior of British Columbia eggs have been found May 21; in North Dakota, May 18; at Great Slave Lake, June 4, and Fort Yukon, June 3.

Fall migration.—In the day of the great flights to Chesapeake Bay the gunners did not expect large flocks of canvasbacks much before the middle of November, but a small number appeared some time earlier. For the last sixteen years the average date of the first arrival at Alexandria, Va., has been October 21 (earliest October 15, 1903). On the average canvasbacks have become tolerably common by November 8; in 1888 by the last of October. These flocks cross Lake Erie early in October, and the height of the shooting season there is toward the end of that month. The first flocks cross the boundary to the upper Mississippi Valley the last week in September and during the month of October spread gradually south to the southern limit of the range in the Valley of Mexico. Southern California is reached about October 20. In 1895 the last were seen at Heron Lake, Minnesota, on November 27.

Aythya marila (Linn.). Scaup Duck; Broadbill; Blackhead; Bluebill.

Breeding range.—The principal summer home of the scaup in the Western Hemisphere is northwestern North America, from northern North Dakota, southeastern British Columbia, and Sitka, Alaska, north to Fort Churchill, Great Slave Lake, Fort Reliance, Alaska, and Kotzebue Sound; also throughout the whole Aleutian chain to the

Near Islands. It breeds accidentally or casually at Mount Vernon, Va., 1881; Magdalen Islands, Gulf of St. Lawrence; Toronto, Ontario; St. Clair Flats, Michigan; Clear Lake, Iowa; Minneapolis and Fergus Falls, Minn.; and Great Whale River, James Bay.

The species also breeds in the arctic regions of the Old World, and winters south to southern Europe and central Asia.

Winter range.—This is one of the principal game birds of the Atlantic coast region from Massachusetts to Chesapeake Bay, and it is probably more common here during the winter than in any other part of its range. The winter range on the Atlantic coast of this and the next species is complementary. The present species is common from Chesapeake Bay northward, while most of the lesser scaups winter south of that district and are most common from North Carolina to Florida. A small proportion of the flocks of the greater scaup pass south to the Carolinas and a few continue on to Florida and the Bahamas. The records for the West Indies seem to belong to the lesser scaup and the same is probably true of the few records for Mexico and Central America.

The species winters regularly on the New Jersey coast and usually on Long Island; its stay in Massachusetts is governed by winter conditions, and during mild winters like those of 1891–92, 1893–94, and 1903–4, it is quite common along the southeastern coast. Occasionally some scaups winter even on the coast of Maine. It occurs throughout the Mississippi Valley in winter north to southern Wisconsin and Toronto, Ontario, though it is hardly more than a straggler in winter north of the Ohio River.

The greater scaup ranges nearly to the southwestern boundary of the United States in southern Texas, southern New Mexico, central Arizona, and to San Diego, Cal. A few winter in southern Colorado, southern Utah, and more commonly in Nevada, and on the Pacific coast north to the Aleutian Islands.

Spring migration.—Few birds have a more pronounced northwest and southeast migration than the greater scaup duck. Its center of abundance in winter is on the Atlantic coast between the meridians of 74° and 76° longitude, but almost all of these Atlantic coast birds breed west of the meridian of 95° longitude, and their route in spring is along the general direction of the chain of lakes that stretches almost due northwestward from Lake Erie to Great Slave Lake. The two routes of migration—south along the Mississippi River and southwest to the New England coast—are revealed still more clearly in the fall, when this species scarcely occurs in Indiana, though common both to the east and west of that State. In spring some of the flocks move north along the coast, slightly beyond their winter home, to eastern Massachusetts, but so large a proportion of them turn inland that the species is rare to the northeastward of this State, straggling to Newfoundland, and once recorded on the eastern coast of Labrador. Average dates of spring arrival are: Montreal, Canada, April 15 (earliest April 7, 1893); Oberlin, Ohio, March 24 (earliest March 9, 1904); central Indiana, March 17 (earliest March 1, 1892); northern Illinois, March 23 (earliest March 6, 1894); southern Ontario, March 30; southern Michigan, March 29; southern Wisconsin, March 13; central Iowa, March 16; Heron Lake, Minn., April 2; southern Manitoba, April 16 (earliest March 31, 1892); in 1905 one was seen March 27 at Indian Head, Saskatchewan, nearly a month earlier than usual. The species was seen May 24, 1901, at Fort Chipewyan, Alberta, and the first was noted May 24, 1904, at Fort Simpson. Its arrival has been noted at Fort Reliance, Yukon, May 1; at St. Michael, Alaska, May 8–10, and on the Kowak River, Alaska, June 1, 1899.

In most seasons about Long Island the last week of March marks the disappearance of the large flocks. Some years they remain during the first few days of April, and the last linger until about the 1st of May.

Eggs have been taken at Minneapolis, Minn., May 13; Oak Lake, Manitoba, May 24, 1892; Kowak River, Alaska, June 14, 1899; St. Michael, Alaska, end of May.

Fall migration.—Soon after the first of October, flocks of 'broadbills' begin to appear near Long Island and the numbers increase all through this month. September 26 is the average date when the first scaups arrive. Early arrivals, on the average, reach Alexandria, Va., October 18, and the species becomes common about the 1st of November. October is the month of arrival for this species throughout most of its winter range in the United States, and the early part of this month is the time of departure from the most northern breeding grounds. The last leave St. Michael, Alaska, October 7 to 15. The last leave Montreal, on the average, November 9 (latest November 14, 1896); the latest was seen at Heron Lake, Minn., November 27, 1885.

Aythya affinis (Eyt.). Lesser Scaup Duck.

Breeding range.—In the case of this species a distinction needs to be drawn between the breeding range and the summer range. Quite a number of nonbreeding individuals spend the summer many miles south of the nesting grounds, so that the eggs or young are the only certain evidence that the species breeds. These nonbreeding birds are not rare on the New England coast, Long Island Sound, and the Great Lakes. The lesser scaup does not breed regularly in northeastern United States nor in any of the Maritime Provinces; indeed, there is scarcely a breeding record for the whole of North America east of Hudson Bay and Lake Huron. The extreme easterly points at which the species breeds are around Lake St. Clair and the western end of Lake Erie in Ohio, Michigan, and Ontario; thence westward, a few breed in northern Indiana (Kewanna, English Lake), southern Wisconsin (Delavan, Lake Koshkonong), northern Iowa (Spirit Lake, Clear Lake), northern Nebraska (probably in Cherry County), Montana (common), and central British Columbia (Cariboo district). The species is rather rare on the Pacific coast and seems to have been found only once on the coast of Alaska (Portage Bay, near Chilkat River), though not rare inland on the Yukon River, breeding as far north as Circle City. The principal breeding range of the lesser scaup is the interior of Canada, from northern North Dakota and northern Montana to the edge of the timber near the Arctic coast in the Anderson River and the Mackenzie River regions.

Migration range.—The route of migration in the fall evidently tends toward the southeast, for at this season the species is not uncommon in New England, and is a rare visitant of Nova Scotia and even of Newfoundland, and is accidental in Greenland and the Bermudas.

Winter range.—The southeastward movement just mentioned brings a large number of lesser scaups to the South Atlantic States, from Maryland southward; indeed, in Florida it is one of the commonest ducks, and continues to be common as far south as the Bahamas, the Greater Antilles, and east to St. Croix, St. Thomas, Virgin Gorda, St. Lucia, and Trinidad. It is not rare in Panama and Costa Rica, while it is abundant in Guatemala, Yucatan, Mexico, and Lower California, and less common on the Pacific slope north to southern British Columbia. The species remains north in winter, on the Atlantic coast as far as New Jersey and Pennsylvania, and in the interior as far as southern Illinois, southern Colorado, and Arizona. There are a few records of its occurrence in winter in western New York.

Spring migration.—An abundant migrant in the upper Mississippi Valley, the lesser scaup is one of the less early ducks to arrive. It has appeared at Keokuk, Iowa, just north of its winter home, on February 26, average of five years (earliest date February 21, 1892); while during another period of five years the average date of its arrival was March 19. The average date of arrival in central Iowa is March 21, as deduced from thirteen years' observations; at Heron Lake, Minn., March 22 (earliest March 5, 1887); central Nebraska, March 29; Loveland, Colo., March 12 (earliest March 8, 1887). The average of six years' observations at Chicago, Ill., gives April 6 as the date of appearance, while in a neighboring locality, English Lake, Ind., it has been taken several times by March 12, and in 1892 on March 6. The average dates are: Central Indiana, March 27; Oberlin, Ohio, March 23 (earliest March 15, 1901); southern Michigan, March 25 (earliest March 11, 1905); Ottawa, Ontario, April 26; Montreal, Canada, April 14; Reaburn, Manitoba, April 9. This species was seen near Pelican Rapids, Alberta, May 7, 1901, and at Fort Simpson, Mackenzie, May 24, 1904. It is one of the later breeding ducks. Young were seen at Mitchells Bay, Ontario, June 6, 1888; eggs at Rush Lake, Saskatchewan, May 28, 1892; and eggs on the lower Anderson June 17, 1865.

Fall migration.—The species remains on its breeding grounds until quite late in the fall, and in the United States rarely becomes numerous before the 1st of October. At Alexandria, Va., the average date of arrival (ten years) is October 12 (earliest, September 25, 1903) and the average date on which it becomes common is October 27. In 1902 the first arrival in northern Florida was seen November 18, and about this date it appears in the Bahamas and in southern Lower California. It is one of the last of the river ducks to leave the far north, and in 1903 was seen at latitude 64° on the Mackenzie River until the middle of October. Average dates when the last were seen are: Montreal, Canada, November 5 (latest, November 12, 1894); Ottawa, Ontario, November 11 (latest, November 21, 1892); southern Manitoba, November 8; southern Minnesota, November 13; Keokuk, Iowa, December 2.

Aythya collaris (Donov.). Ring-necked Duck.

Breeding range.—The summer home of this species seems to comprise two general areas separated by the Rocky Mountains. The greater number breed in the interior, from North Dakota and Minnesota north to Athabasca Lake and east to the western side of Lake Winnipeg. It breeds rarely south to southern Minnesota (Minneapolis, Heron Lake), northern Iowa (Clear Lake), and to southern Wisconsin (Lake Koshkonong; Pewaukee Lake). Though eventually the species may be found breeding in Alberta, at present there seems to be no certain nesting record for the entire Rocky Mountain chain from New Mexico to Alberta. West of the Rockies the ring-necked duck seems to breed in small numbers from Fort Klamath, Oreg., to southern British Columbia (Cariboo district). It is said to breed also on the Near Islands, Alaska.

Winter range.—The Gulf coast, from Florida to Texas, is the principal winter home of the ring-necked duck, and here locally it is the most abundant duck at this season. It is common also in the Bahamas and Cuba, rare in Jamaica, and has been noted once in Porto Rico, and once in the Bermudas. On the mainland it is rare in California and Lower California, common in Mexico, and ranges to central Guatemala. Northward it is common in the Carolinas, rare to Maryland and New Jersey, and thence westward to southern Illinois, northern Texas, New Mexico, and north on the Pacific coast to southern British Columbia.

Spring migration.—Along the Atlantic coast from Massachusetts northward to Newfoundland this species is a rare migrant, and is one of the later ducks to move. The average date of arrival at Erie, Pa., is April 16 (earliest March 15, 1903). The migration in the Mississippi Valley is somewhat earlier; average dates are: English Lake, Ind., March 11 (earliest February 27, 1892); Keokuk, Iowa, March 14 (earliest March 4, 1894); Heron Lake, Minn., March 27 (earliest March 15, 1894). The first arrival was noted at Osler, Saskatchewan, May 2, 1893, and at Fort Chipewyan May 22, 1893. Eggs have been taken at Pewaukee Lake, Wisconsin, May 20, 1867; Minneapolis, Minn., May 27, 1876; Turtle Mountain, N. Dak., June 14, 1898; Rush Lake, Saskatchewan, June 15, 1892.

Fall migration.—Southward migration in the Mississippi Valley is earlier than it is along the Atlantic coast; in the former the bird reaches the Gulf coast about the middle of September, and has been noted in the Valley of Mexico September 28; along the Atlantic it appears at Alexandria, Va., on the average, October 23 (earliest arrival October 6, 1901), and it becomes common at an average date of November 11. It was seen near Athabasca Landing September 4, 1903. The average date when the last migrants were seen at Ottawa, Ontario, was October 30 (latest November 21, 1892); latest in Massachusetts November 23; Erie, Pa., December 3, average date of the last arrivals in southern Minnesota (eight years) November 13.

Clangula clangula americana (Bonap.). American Golden-eye.

Breeding range.—This is one of the more northern-breeding ducks, but its choice of hollow trees as nesting sites prevents the extension of its breeding range into the treeless Arctic regions, to which it seems well suited by its hardy constitution. It has been noted north to Ungava Bay, Labrador; Fort Churchill, Hudson Bay; and Fort Good Hope, near the mouth of the Mackenzie River. It is probable that the species breeds in the heavy timber nearest to these places. In Alaska it breeds commonly in the interior about as far north as the Arctic Circle, but is very rarely seen on the coast. The species breeds from Newfoundland to British Columbia, north to the Noatak River, but the breeding range extends only a little into the United States, to southern Maine (Calais, Magalloway River), northern New Hampshire (Lake Umbagog), northern Vermont (St. Johnsbury), northern New York (Adirondacks), northern Michigan (Neebish Island, Sault Ste. Marie), North Dakota (Devils Lake), Montana (Flathead Lake), and in British Columbia so close to the southern boundary that the species will probably be found to breed in northern Washington.

The typical form, *Clangula clangula*, breeds in northern Europe and northern Asia, migrating southward to northern Africa and southern Asia.

Winter range.—As this is one of the hardiest ducks, its northern distribution in winter is governed by the presence of open water. It is tolerably common on Lakes Michigan, Erie, and Ontario, and in mild winters, as that of 1888–89, it remains north to Prince Edward Island. It is common in winter all along the New England coast, and continues to be common to North Carolina, less common in South Carolina, and rare or accidental to the southward. All records for the West Indies seem to be erroneous. It was once seen at sea near the Bahamas, has been taken a few times in the Bermudas, and has been seen a few times in Florida; it is not rare at the mouth of the Mississippi River, but is quite rare in Texas and New Mexico, is recorded in Mexico (Mazatlan and northeastern Lower California), and is rare in southern California. In the interior it remains during the winter north to Iowa, Nebraska, and Utah, while on the Pacific coast it is found at this season north to the Aleutian Islands.

Spring migration.—The spring records of this species are very irregular, as might be expected from its habit of wintering far north near large bodies of water. Observers on the coast of Maine report it as common all winter, while inland in southern Maine the first was not seen (average eight years) until April 5 (earliest March 27, 1902); at Montreal, Canada (average nine years), April 4 (earliest March 19, 1894); North River, Prince Edward Island, April 8, and at Lake Mistassini, Quebec, May 3, 1885. At Ottawa, Ontario, it was one of the most irregular birds in its arrival. In twelve years out of eighteeen the first arrival was not noted until April, average April 12; for five years the first came in March, and in 1885 the first was seen February 14. Other average dates of arrival are: Southern Ontario, April 5; northern Iowa, March 21; Heron Lake, Minn., March 25 (earliest March 14, 1889); northern North Dakota, April 20; southern Manitoba, April 21 (earliest March 29, 1902). The first golden-eyes have been noted at Great Falls, Mont., March 9–22; central Alberta, April 7–17; Osler, Saskatchewan, May 2, 1893; Fort Resolution, Mackenzie, May 7, 1860, and Nulato, Alaska, May 3, 1868. An unusually early bird was seen on April 28, 1904, at Fort Simpson, Mackenzie. Eggs have been taken at Devils Lake, N. Dak., May 25, 1903; near Lake Athabasca June 6, 1903; downy young at Reaburn, Manitoba, July 4, 1893, and well-grown young June 23, 1894, near Ottawa, Ontario.

Fall migration.—The golden-eye is one of the late ducks to migrate southward, seldom appearing south of its breeding range before October and usually not until the latter part of that month. A long series of excellent notes at Alexandria, Va., shows the average date of arrival to be October 26 (earliest, October 8, 1901); on the average the species did not become common until November 11. The average date of appearance at Woods Hole, Mass., is November 15 and at Keokuk, Iowa, November 24. The average date when the last were seen at Montreal, Canada, is November 7.

Clangula islandica (Gmel.). Barrow Golden-eye.

Breeding range.—A few breed in eastern Canada from the Gulf of Saint Lawrence (Point des Monts) to northern Labrador (Davis Inlet). A few are found in Greenland during March and April and in November and December as far north as Holstenborg, 67° latitude, but the species apparently does not breed there, though breeding quite commonly in Iceland. The principal summer home is in the Rocky Mountains, where the species breeds from southern Colorado (Dolores County) north almost to the Arctic coast (Fort Anderson), though north of the United States there are only a few records in the entire district. On the Pacific slope the species breeds quite commonly in central British Columbia and less commonly north to Lake Clark, Alaska. The most southern record of breeding on the Pacific slope seems to be the one made by one of the parties of the Biological Survey at Paulina and Diamond lakes, Oregon.

Winter range.—The larger number of the breeding birds of eastern Canada spend the winter around the Gulf of St. Lawrence, but a few straggle south and have been recorded at this season from Maine, New Hampshire, Massachusetts, New York, Virginia, and on four occasions from North Carolina. In the interior they have been recorded a few times in the States around the Great Lakes and even in Nebraska. The Rocky Mountain breeding birds pass in winter scarcely south of their summer range and are found from southern Colorado (Fort Lewis) to Montana (Fort Sherman and Great Falls). The Pacific birds winter from southern Alaska (Portage Bay) to California (San Francisco).

Spring migration.—Records of this species are too few to allow of exact statements in regard to its migration; indeed, over most of the range of the species the winter and summer homes overlap. Migrants were noted at Quebec City, April 14, 1899, and April 16, 1904. One was seen near Asheville, N. C., in 1893 as late as May 6. One was taken at Fort Anderson, Mackenzie, June 14, 1864.

In Iceland the species begins breeding in May or early June. At Godbout, Quebec, young were found July 11, 1881. Incubated eggs were taken June 17 in central British Columbia.

Fall migration.—The earliest fall migrants in 1897 at Montreal were seen October 23. One was taken near Washington, D. C., November 22, 1889, and one at Lake Koshkonong, Wisconsin, November 14, 1896.

Charitonetta albeola (Linn.). Buffle-head.

Breeding range.—In the nesting season the buffle-head is almost wholly confined to Canada, but a few breed in Wisconsin (Pewaukee Lake), northern Iowa (Storm, Clear, and Spirit lakes), Wyoming (Meeteetse Creek), Montana (Milk River, Flathead Lake). It is a tolerably common breeder in the northern two-thirds of Ontario, and undoubtedly some pairs breed in Quebec and southern Labrador, though it is as yet unrecorded from there, from the Maritime Provinces, and from Newfoundland, except as a rather rare visitant. In Manitoba and westward to British Columbia it becomes more common as a breeder, and ranges north to Fort Churchill, Fort Rae, the mouth of the Mackenzie, and the upper Yukon, rarely to the Yukon mouth. It has been taken as a rare straggler on the west coast of Greenland (Godhaven, October; Frederikshaab), and a few times in Europe.

Winter range.—A single specimen was found in the market at Habana, and this constitutes the only record south of the eastern United States. To the westward a few enter Mexico to the Valley of Mexico and Lower California to San Quentin. It is a common winter resident of the southern half of the United States, north to Massachusetts; Lakes Ontario, Huron, and Michigan; Utah, Idaho, British Columbia, Unalaska Island, and the Near Islands. It is casual in winter in the Bermudas and there is one record from the Commander Islands, Kamchatka.

Spring migration.—As with most of the hardy ducks, spring migration begins in February, and by the middle of March the buffle-head is fairly common in the district where it winters only locally and during exceptionally mild seasons. Average dates of arrival are: Renovo, Pa., March 18 (earliest February 29, 1904); New Brunswick and Nova Scotia, March 22; central Indiana, March 2; northern Illinois, March 21; southern Michigan, March 31 (earliest March 1, 1887); southern Ontario, April 7 (earliest April 1, 1903); Ottawa, Ontario, April 24 (earliest March 26, 1898); southern Iowa, March 22 (earliest March 1, 1891); Heron Lake, Minn., March 26 (earliest March 6, 1889); southeastern Minnesota, April 5; Elk River, Minn., April 11; central South Dakota, April 8; southern Manitoba, April 25; Osler, Saskatchewan, May 2, 1893; Fort Simpson, Mackenzie, May 11, 1904. Eggs have been taken at Fort Simpson May 25, 1860, and at Fort Yukon, June 7, 1862.

Fall migration.—This species is late in entering the United States, September records being rare, except in the extreme northern part, and even here the species is scarcely common before the middle of October. At Renovo, Pa., the average date of arrival is November 10, though in 1901 the first was seen September 21. The average date of the last migrants at Montreal was November 1, and at Ottawa, Ontario, November 8. One was taken at Fort Reliance, on the upper Yukon, October 7.

Harelda hyemalis (Linn.). Old-squaw.

Breeding range.—The summer home of this species includes the Arctic coasts and most of the islands. It is abundant to the northern part of Banks Land and thence east to North Somerset Island and the south shore of Lancaster Sound—that is, to about latitude 74°. On the western coast of Greenland it is common to about latitude 72°. A few pass much farther north to Melville Island, Wellington Channel, and along the whole western coast of Greenland and on Grinnell Land to at least latitude 82°. The old-squaw breeds south to the southeastern coast of Labrador, to Cape Fullerton on the west side of Hudson Bay and probably to Cape Jones on the eastern coast. Along the whole coast of the mainland from Hudson Bay to Alaska it breeds in enormous numbers, and is a common breeder on the Alaskan coast to the Aleutian and Near islands and on the Asiatic coast to the Commander Islands. The species breeds in the Arctic regions of the Old World and winters south to southern Europe and central Asia.

Winter range.—Old-squaws are common south to Chesapeake Bay and not rare as far south as the coast of North Carolina. So abundant are they on the New England coast that near Newport, R. I., in February, 1899, a flock was seen that was estimated to contain at least 50,000. During the winter of 1887–88, a few were noted at Charleston, S. C., and during the severe winter of 1894–95, flocks were seen off the coast of South Carolina. There are two records for Florida—near Titusville and in Leon County. In mild winters old-squaws remain in the Gulf of St. Lawrence, and some occur at this season in southern Greenland. They winter abundantly on the Great Lakes, and have been noted as casual visitors at St. Louis, Mo., April 1, November 20, and March 14; New Orleans, La., February 28, 1885, and February 13, 1899; Nebraska (Omaha, Neligh), Kansas (Patterson Lake, Gantz Mill), and Colorado (Fort Collins, Longmont, Denver). This species winters on the Pacific coast from the Aleutian Islands southward; it is tolerably common to the coast of Washington, and not rare to northern California; it is casual in southern California as far south as San Diego Bay.

Spring migration.—The principal movements of old-squaws along the New England coast are in April, and this is the time also when the species migrates through western Pennsylvania and western New York. The first of those that have moved south reappear at Grand Manan, New Brunswick, on an average date of March 9, and at Godbout, Quebec, April 22. North of its winter quarters it is one of the earliest ducks to arrive, and has been noted at Fort Simpson, Mackenzie, 62°, May 10, 1904; Winter Island, latitude 66°, May 3, 1822; Igloolik, latitude 69°, May 21, 1823; Boothia Felix, latitude 70°, June 12, 1830, June 20, 1831, about June 16, 1833, and not until after June 25, 1832; Prince of Wales Strait, latitude 75°, May 31, 1851; Mercy Bay, June 13, 1852; Winter Harbor, latitude 75°, June 22, 1820; Cape Sabine, latitude 78°, June 1, 1884; Van Rensselaer Harbor, latitude 79°, June 16, 1854; Fort Conger, latitude 81°, June 17, 1882, June 6, 1883; Floeberg Beach, latitude 82° 40′, July 12, 1876. The last usually leave the eastern United States about the 1st of May (Erie, Pa., May 18, 1900). The last were seen at Fort McMurray, Alberta, May 15, 1901. On the Pacific coast, the first old-squaws were noted at Chilcat, Alaska, March 11, 1882; off the mouth of the Yukon, stragglers usually arrive early in April as soon as open water appears; the main migration is several weeks later, and the first arrivals appear at Point Barrow late in May (May 18, 1882; May 24, 1883; May 31, 1898). The first reached the mouth of the Kowak River, Alaska, May 22, 1899.

Eggs have been taken at St. Michael, May 18; on the Pribilof Islands, June 12; near the Kowak River the last of June; Fort Anderson, Mackenzie, June 7, 1864, June 14, 1865; northwestern Hudson Bay, June 27; Ungava Bay, Labrador, June 16.

Fall migration.—Fall migration had already begun and large flocks had passed south to Great Bear Lake in 1903 by August 28, and were still numerous there September 17. An unusually early migrant was seen near Erie, Pa., September 13, 1876. Early dates are September 30, 1895, on the coast of Massachusetts, and October 8, 1885, on Long Island. The average date of arrival for six years on the coast of Massachusetts is October 11, and for nine years on Long Island, October 16. The birds are most abundant the first half of November, after which month the larger number pass on to more southern waters. The last were seen near northern Greenland, latitude 82°, September 16, 1875. Most leave Point Barrow in early October, but a straggler was seen there December 9, 1882. They leave the coast of Alaska, off St. Michael, from the 15th to the 20th of October.

Histrionicus histrionicus (Linn.). Harlequin Duck.

Breeding range.—The harlequin breeds commonly in Newfoundland and on the whole west coast of Greenland south of Upernavik, latitude 72°, on the east coast north to Scoresby Sound, and in Iceland; also along the north coast of Labrador, at Ungava Bay, and Hudson Strait. There is no reason for doubting that its breeding range is continuous from northern Labrador west to the mouth of the Mackenzie River, though breeding records from this region are wanting. The species was noted by one of the parties of the Biological Survey August 20 and 24, 1903, a short distance south of MacTavish Bay, Great Bear Lake, in latitude 65° 30′, where it was probably breeding. It has been taken also at Fort Rae, at Fort Simpson, and on Bear Lake River. It is known to breed from the mouth of the Mackenzie west to Kotzebue Sound and to the Siberian coast. It occurs in summer on most of the islands west of Alaska, south to the Shumagin Islands, and in the Aleutian chain west to the Near Islands and to the Commander Islands off the coast of Asia. Most, if not all, of these birds, however, are nonbreeders. It has been noted breeding at several localities in the interior of Alaska, and breeds locally throughout the mountainous region of western North America south to southwestern Colorado and to central California at about latitude 38°.

Winter range.—The harlequin is not rare at this season in the southern part of the Gulf of St. Lawrence, and thence is less common to Long Island Sound; it is accidental on the New Jersey coast, and once, March 20, 1886, has been noted at Pensacola, Fla. It is not uncommon in winter on Lake Michigan; an accidental was noted October 29 near St. Louis. It winters in Colorado at the southern limit of its breeding range but at several thousand feet lower altitude. On the Pacific coast it winters abundantly in the Aleutians and the Pribilof Islands; west to the Near Islands, the Commander Islands, and rarely to Japan; also along the coast of California to Monterey and in the interior to about 36° latitude (near Crockers Station). Accidental in Europe.

Spring migration.—The few individuals that winter on the Atlantic coast of the United States retire northward in January and early February, but some linger just south of the breeding grounds in the Gulf of St. Lawrence until late May. The species arrives on the coast of Greenland in March. On the Pacific coast the winter and breeding ranges so overlap that no regular progression northward can be distinguished. Migratory movements are noticeable on the coast of Oregon the last of March; the species was noted at Fort Simpson, Mackenzie, May 25, 1904; the van usually arrives at the mouth of the Yukon about the 1st of June.

Fall migration.—The first arrivals off the coast of Massachusetts do not appear until about the beginning of November, when the last are leaving the Greenland breeding grounds. The first arrivals have been noted at Toronto, Ontario, October 20, 1894, and at Omaha, Nebr. (accidental), September 16, 1893; September 19, 1895.

Camptolaimus labradorius (Gmel.). Labrador Duck.

This is an extinct species, which within the last century nested from Labrador northward. During the winter it visited the coast of New England and passed as far south as Long Island and New Jersey, possibly to Chesapeake Bay. So far as known the last survivor was captured in 1871 at Grand Manan, New Brunswick. Forty-three specimens are known to be in museums.

Polysticta stelleri (Pall.). Steller Eider.

Breeding range.—The principal summer home of this duck is along the northern coast of Siberia, where the species is enormously abundant. Thence it breeds on the eastern coast and islands south to the Near Islands, Unalaska, and the Shumagins. Eggs have been found at Unalaska May 18, in northern Siberia June 25, and downy young at Point Barrow, Alaska, July 28.

Winter range.—The Steller eider winters abundantly on the Near Islands and as far north as Unalaska, the Shumagins, and the Kenai Peninsula. The winter range extends south on the Asiatic coast to the Kurile Islands.

Spring migration.—The northward migration is limited chiefly to May. The first arrivals have been noted at Point Barrow June 5, 1882, June 11, 1883, June 9, 1898. During migration the species is fairly common along the coast of Alaska at Bristol Bay, the mouth of the Yukon, and in Norton Sound.

Fall migration.—The first arrival in the fall has been noted at St. Michael, Alaska, September 21. The southern limit of the winter home is reached about the 1st of November. The latest date at Point Barrow is September 17, and the last migrants leave St. Michael about the middle of October.

The Steller eider has occurred accidentally at Disco Bay, Greenland, in the fall of 1878; at Godbout, Quebec, February 17, 1898, and also at Point des Monts, Quebec.

Arctonetta fischeri (Brandt). Spectacled Eider.

Breeding range.—The spectacled eider has a more restricted range than any other of the family. It breeds north to Point Barrow, Alaska, and thence along the coast to the mouth of the Kuskokwim River. The range extends also along the northern coast of Siberia to the mouth of the Lena, but the species has not as yet been taken breeding on the Asiatic side. By far the greater number of individuals nest around Norton Sound.

Winter range.—Winter records are almost wanting; the species has been noted at this season on the Near Islands and Unalaska, and it is probable that the Aleutian chain constitutes the principal winter home.

Spring migration.—The breeding grounds are reached in May, the earliest record at Norton Sound being May 6, and the usual date a week or more later. The first have been noted at Point Barrow May 29, 1882, May 26, 1883, and May 31, 1898.

Fresh eggs have been found at St. Michael June 10, and newly hatched young July 23; downy young were secured at Point Barrow July 28, 1898.

Fall migration.—The latest records at Point Barrow are August 24, 1883, and September 17, 1897. During this latter month all the breeding grounds from Norton Sound northward are deserted.

Somateria mollissima borealis (C. L. Brehm). Northern Eider.

Breeding range.—This eider breeds in northeastern North America, south to Hamilton Inlet, Labrador, about latitude 54°; west to Southampton Island and Cape Fullerton, latitude 63°; north on the east coast of Greenland to Shannon Island, latitude 75°, and on the west coast to Dumb-bell Bay, latitude 82°; not abundant north of about 78° latitude. There is a lack of definite knowledge concerning the western limits of the range of this species. It is certain that the eiders of Hudson Bay, west to longitude 87°, belong to this form. It is also certain that the common eider on the Arctic coast of northwestern North America is *S. v-nigra*, and that this form occurs east along the coast of the mainland to about the mouth of the Coppermine River, 115° longitude. There seems to be no specimen of either form in any collection from the Arctic islands west of Baffin Bay. It is a fair presumption that the eiders of Wellington Channel and vicinity—longitude 90°–95°, where the species is common north to 77° latitude—belong to the eastern form and that those of Banks Land, longitude 115°–125°, are *S. v-nigra*, but the dividing line between the two forms remains to be determined. The typical form, *Somateria mollissima*, breeds in northwestern Europe and comes south in winter rarely to southern Europe.

Winter range.—In winter the northern eider ranges from southern Greenland and northern Hudson Bay south on the Atlantic coast to Massachusetts.

Spring migration.—Just north of the winter range, at Cumberland Sound, latitude 66°, the first appeared April 30, 1878; in Wellington Channel, latitude 76°, May 17, 1851; at Cape Sabine, latitude 79°, May 28, 1884; and at Thank God Harbor, latitude 81°, June 4, 1872. The latest stragglers on the coast of New England leave the first week in April. The first eggs on Cumberland Sound were found June 21, 1878; the first at the south end of Greenland, June 24, 1886.

Fall migration.—The earliest migrants arrive on the coast of Massachusetts the last of October; the last were seen at Dumb-bell Bay, September 5, 1875; at Thank God Harbor, November 4, 1872; and in Cumberland Sound, November 17, 1878.

Somateria dresseri Sharpe. American Eider.

Breeding range.—The American eider rarely breeds on the coast of Maine; formerly its breeding range extended to the western side of Penobscot Bay, but is now restricted to a few colonies in Jericho Bay and on Old Man Island; it breeds abundantly on the shores of the Gulf of St. Lawrence and is fairly common north to the mouth of Hamilton Inlet, latitude 54°; it breeds commonly on the east shore of Hudson Bay, from latitude 54° to latitude 56°, and on the west shore in the vicinity of Fort Churchill.

Winter range.—The American eider winters as far north as Newfoundland; is common in the Gulf of St. Lawrence through the winter, and is not uncommon as far south as the Massachusetts coast; it is casual on the New Jersey coast, and is accidental near Marshall Hall, Md., and near Cobbs Island, Virginia (December 28, 1900). In the interior it has occurred on the Great Lakes; at Ottawa, Ontario; Licking Reservoir, Ohio; Lake Koshkonong, Wisconsin; and Loveland, Colo.

Spring migration.—After severe winters, when they have been driven away by the ice, American eiders return to Prince Edward Island about the last week in March and to Newfoundland the first of April. The last are seen on the Massachusetts coast in April (April 18, 1890; April 20, 1891; April 12, 1893; April 20, 1894; an unusually late bird was seen May 18, 1892). Eggs were found at Grand Manan, New Brunswick, May 31, 1833, and young on the south coast of Labrador July 4, 1860.

Fall migration.—They first appear off the Massachusetts coast early in November, occasionally in October (October 10, 1890; October 30, 1892), and are common by the end of November.

Somateria v-nigra Gray. Pacific Eider.

Breeding range.—The principal summer home of this eider is on the coasts and islands of Bering Sea and along the coast of the Arctic Ocean between the mouths of the Mackenzie and the Coppermine rivers. The species breeds west to the northeastern coast of Siberia and south to Cook Inlet, Kadiak Island, the Aleutians, Near, and Commander islands; it is accidental in the interior at Great Slave Lake and at Lawrence, Kans. It is probable that the eiders so abundant on Banks Land belong to this form and that a few range north to Melville Island.

Winter range.—The species seems to be massed during winter at the southern portion of the breeding range in the vicinity of the Aleutians.

Spring migration.—Early arrivals are sometimes seen near the mouth of the Yukon the last of April, but usually they appear about May 10. At Point Barrow the dates of arrival are May 16, 1882, and May 19, 1883. On the Kowak River eggs were found June 2, and the young appear about the first of July. Incubation seems to be simultaneous over all the district from the mouth of the Yukon to that of the Anderson.

Fall migration.—Pacific eiders seem to disappear from all points in their summer haunts at about the same time, the first week in October, but for several weeks previously numbers migrate along the north coast of Alaska. Many individuals winter and summer in the same locality, while the birds breeding about the mouth of the Coppermine River migrate at least 2,000 miles.

Somateria spectabilis (Linn.). King Eider.

Breeding range.—The king eider breeds in the arctic regions. It is abundant on the west coast of Greenland, breeding from latitude 66° north as far as land goes, to at least latitude 82° 30′; south to Nachvak, Labrador, latitude 59°; Southampton Island, Hudson Bay, latitude 63°; west along the Arctic coast to Icy Cape and Point Barrow, to St. Lawrence Island in Bering Sea, and on the whole coast of northern Siberia. It seems to be rather rare in northeastern Europe. It is abundant on the arctic islands north at least to Melville Island, latitude 76°, and to the same latitude in Wellington Channel.

Winter range.—This species winters as far north as open water can be found, at least to southern Greenland. It is common during the winter in the Gulf of St. Lawrence, whence a few stray each winter to Long Island Sound and the New Jersey coast; casual at Cape Charles, Va., January 2, 1897; Ossabaw Island, Georgia, December 1, 1904; St. Catherine Island, Georgia, December 3, 1904; Brunswick, Ga., April 25 and May 5, 1890.

The species has been noted occasionally in the interior on Lakes Cayuga, Oneida, Ontario, Erie, and Michigan. The Pacific birds winter abundantly in the Aleutians, south to the Shumagin and Kadiak islands; accidental near San Francisco, winter of 1879.

Spring migration.—Even as far north as Greenland migratory movements of the king eider are noticed in early February; the first arrival was noted at Igloolik, latitude 69°, April 16, 1823; Wellington Channel, latitude 76°, June 9, 1851; vicinity of Fort Conger, latitude 82°, June 12, 1872; June 16, 1882; June 11, 1883. The Pacific birds arrived at Point Barrow, latitude 71°, April 27, 1882, and May 5, 1883; eggs, Floeberg Beach, latitude 82° 30′, July 9, 1876. The last breeding birds desert southern Greenland late in April, though nonbreeders are not rare through the summer, and it is probably the presence of these that has given rise to reports that the species breeds in the Gulf of St. Lawrence; late birds have been recorded on the Massachusetts coast April 5, 1890; April 10, 1893; April 12, 1894; on Long Island April 21, 1887, and, as already noted, at Brunswick, Ga., May 5, 1890.

Fall migration.—This eider wanders south in late fall, the average date when it arrives on the coast of Massachusetts and Long Island being November 14 (earliest, October 21, 1899); it was noted on Lake Erie November 13, 1894, and at Calgary, Alberta, November 4, 1894. The height of the fall migration at Point Barrow is during September and October, and in 1882 the last one was seen there December 2, off St. Michael October 12, 1879, and at Fort Simpson, Mackenzie, October 25, 1903.

Oidemia americana Sw. & Rich. American Scoter.

Breeding range.—The lack of information in regard to the breeding of this species in northeastern North America is surprising. The species was described from the west shore of Hudson Bay, and occurs on the coasts of Labrador and the Gulf of St. Lawrence, but there seems to be no record of the discovery of the nest in this region. Nonbreeding birds are known to occur far south of the breeding grounds. The species is unknown from the whole vast interior of North America, between Hudson Bay on the east and the Yukon Valley on the west, and south almost to the United States boundary; it ranges north to Ungava Bay, Hudson Strait, and Fort Churchill, Hudson Bay, and apparently does not breed south of Newfoundland, nor in Labrador south of about latitude 52°; so that it follows by exclusion that the multitudes of these ducks that winter from the Gulf of St. Lawrence south along the Atlantic coast must breed in northern Ungava.

The American scoter is much more abundant on the Pacific coast, and breeds from the Aleutians and Near Island north to Kotzebue Sound and northeastern Asia.

Winter range.—The American scoter remains in winter around Newfoundland, except when it is driven away by the drift ice; thence south it is not uncommon to Long Island Sound and the coast of New Jersey, less common to South Carolina, rare or accidental in Florida; it is not rare on the Great Lakes during the winter, and has been observed at various places inland in the neighboring States; rare or accidental at St. Louis, Mo.; Lake Catherine, Louisiana; Lincoln, Nebr.; Fort Collins, Colo.; and Cheyenne, Wyo. The Pacific birds winter from the Aleutian Islands to the Santa Barbara Islands, California, and also to Japan on the Asiatic side.

Spring migration.—Arrivals from the south appear in the Gulf of St. Lawrence from March 25 to the first week in April, and the breeding grounds are reached soon after the middle of May. Most of the birds disappear from the coast of Massachusetts the last week of April, but belated individuals have been seen at Cobb Island, Virginia, May 19, 1891; Shelter Island, N. Y., June 5, 1893; and Woods Hole, Mass., June 10, 1891. On the Pacific side the first arrivals were noted at St. Michael, Alaska, May 16, and in Kotzebue Sound June 3. A few linger on the Pacific coast of the United States until early May.

Fall migration.—An American scoter was noted at Black River, Lewis County, N. Y., September 27, 1877; one at Ottawa, Ontario, September 21, 1887, and one at Woods Hole, Mass., September 9, 1891, but the regular flight does not occur until early October, and at about the same time the first migrants are seen on the coast of Puget Sound. The last ones leave St. Michael, Alaska, from the 10th to 15th of October.

Oidemia fusca (Linn.). Velvet Scoter.

This is an Asiatic and European species, an individual of which was taken in May, 1878, near Godthaab, on the western coast of Greenland.

Oidemia deglandi Bonap. White-winged Scoter.

Breeding range.—This scoter breeds along the north shore of the Gulf of St. Lawrence and north to Nachvak Bay, Labrador, about latitude 59°; in the interior it breeds in North Dakota (Devils Lake), Manitoba, Alberta, and north to Hudson Bay and the Arctic coast. On the Pacific coast it breeds from British Columbia (158-Mile House) north to Kotzebue Sound and the coast of northeastern Siberia, rarely to Point Barrow. It is not common anywhere in Alaska. Nonbreeders remain as far south in summer as the coast of California and are not uncommon along the New England coast south to Rhode Island.

Winter range.—The Gulf of St. Lawrence and south along the Atlantic coast to South Carolina—accidental in Florida—constitutes the winter range. The species is especially common on the coast of Massachusetts and Long Island Sound. In the interior it extends its range south regularly and commonly to the Great Lakes; less commonly to the smaller bodies of water in the neighboring States; casually to Louisiana, Illinois (opposite St. Louis), Iowa (Lost Island Lake), Nebraska (Omaha, Lincoln), Colorado (Fort Collins, Loveland, Longmont, Denver). It winters on the Pacific coast from Unalaska Island to San Quentin Bay, Lower California.

Spring migration.—Early northward movements on the New England coast begin late in March, and at about this time the first migrants appear in the Gulf of St. Lawrence; the principal flights occur from the middle of April to the first week in May. At Heron Lake, Minn., where the species does not winter, the first were noted April 6, 1888; March 21, 1889; April 5, 1890, and April 9, 1891; at Aweme, Manitoba, April 27, 1897; April 15, 1898, and April 22, 1899. In the Devils Lake region of North Dakota the earliest eggs are laid about the middle of June, and the first eggs were taken at Lake Manitoba in 1894 on June 26. These dates seem late, since eggs were taken near Fort Anderson, Mackenzie, June 22, 1865, and downy young were found near Fort Yukon, Alaska, June 23, 1866.

Fall migration.—Unusually early arrivals have been noted on the Massachusetts coast by August 10; the average date when the first of the regular flight appear is September 6, and the greater flocks pass October 10–20; the first were seen near Baltimore, Md., September 12, 1894, and the same latitude in the interior seems to be reached a month later, as attested by the following dates of arrival: Heron Lake, Minn., October 11, 1886; Lincoln, Nebr., October 14, 1899; Denver, Colo., October 16, 1890; Longmont, Colo., October 20, 1901; Loveland, Colo., October 11, 1903. On the coast of California migrants arrive the last of August.

Oidemia perspicillata (Linn.). Surf Scoter.

Breeding range.—This species breeds in northeastern Quebec (Point de Monts), southern Labrador, and Newfoundland, north as far as Hudson Strait; it is a summer visitor to the east coast of Greenland (Kangerajuk) and to the west coast as far north as Disco Bay, but is not known to breed; accidental in northern Europe; breeds abundantly at Fort Churchill, Hudson Bay, at Great Slave Lake, probably at Athabaska Lake, and north to the Arctic coast, west to the mouth of the Mackenzie. It is a common breeder on the headwaters of the Yukon, and from Sitka north to Kotzebue Sound. The species apparently is lacking on the north coast of Alaska, but nonbreeding birds are abundant on the coast of northeastern Siberia. Nonbreeders are found also all through the summer on the Atlantic coast south to Long Island and on the Pacific coast to Lower California.

Winter range.—The surf scoter remains around the Gulf of St. Lawrence until forced away by ice, and passes the winter from about the Bay of Fundy south to Florida. It is enormously abundant from Massachusetts to New Jersey, and still common to North Carolina; accidental in the Bermudas; it visits commonly the Great Lakes and extends south rarely to Louisiana (New Orleans, March 20, 1890), Illinois (opposite St. Louis, May 3, 1876), Kansas (Lawrence, October 29, 1887), Nebraska (Lincoln, October 7, 1896; Omaha), Colorado (Loveland, October 31, 1899; Denver, October 22, 1899), Wyoming (Douglas, October 19, 1893); on the Pacific coast from the Near Islands, and the Aleutians south to San Quentin Bay, Lower California.

Spring migration.—Birds from the south occasionally return to Nova Scotia late in March, more commonly the first week in April, and reach their breeding grounds about the first week in May. Those that migrate through the interior are nearly three weeks later. The Alaskan breeding grounds are reached about the middle of May. Eggs have been taken at Fort Anderson June 25 and downy young near Fort Yukon June 23.

Fall migration.—In 1900 stragglers appeared off the coasts of Maryland and Virginia the last week in August, about three weeks earlier than usual. The first fall migrants commonly arrive on the coast of Massachusetts and Long Island Sound the middle of September and are followed the second week in October by the main flight. The last leave the Gulf of St. Lawrence on the average November 7. Arrivals on the Great Lakes are rather later than in corresponding latitudes on the coast. A few surf scoters are seen on the California coast in July and August, though the main body hardly appears before November. They leave St. Michael, Alaska, and the upper Mackenzie about the middle of October.

Erismatura jamaicensis (Gmel.). Ruddy Duck.

Breeding range.—The principal summer home of the ruddy duck is in the upper Mississippi Valley and the contiguous portions of central Canada; it is rare east of the Alleghenies; breeds regularly from Maine to northern Ungava; rare visitant in Newfoundland; nesting rarely south to Massachusetts (Cape Cod) and probably in Rhode Island (Sakonnet); tolerably common in southern Ontario, Michigan, and Wisconsin, and probably breeds casually in Ohio and Illinois. West of the Mississippi it breeds regularly to southern Minnesota and northwestern Nebraska and rarely in Kansas. The breeding range then dips strongly to the south in the mountains through Colorado to northern New Mexico (La Jara and Stinking Spring lakes), central Arizona (Stoneman Lake, altitude 6,200 feet), southern California (Los Angeles County), northern Lower California to about latitude 31°, and probably northwestern Chihuahua (Pacheco). The breeding range on the Pacific slope extends north at least to central British Columbia (Cariboo District); in the interior to Great Slave Lake and Hudson Bay (York Factory). The above is the normal breeding range, but this species has the peculiar habit of establishing colonies far to the southward. Such colonies have been discovered at Santiago, near the southern end of Lower California, in the Valley of Mexico, at the Lake of Duenas, Guatemala, and on the islands of Cuba, Porto Rico, and Carriacou. The breeding season of these isolated colonies bears no relation to the usual breeding time in the bird's ordinary range. In northern North Dakota the earliest eggs are deposited the first week in June; in Manitoba and Saskatchewan incomplete sets were found the middle of June; the same date—the middle of June—marks the deposition of the eggs in central Colorado. The first half of June may be said to be the usual time for the beginning of nesting. On Cape Cod, Massachusetts, downy young were taken August 17; in northern New Mexico September 17; in southern Lower California, November 16; at Lake Duenas, Guatemala, in June; while in Cuba and Porto Rico eggs were taken in November, and on Carriacou Island in January.

Winter range.—In its choice of climate and environment the ruddy duck varies widely. While many individuals retire in winter to the southern part of the range, to southern Lower California, Tepic, Valley of Mexico, Oaxaca, and central Guatemala, others remain as far north as southern British Columbia. The northern limit in the Rocky Mountain region is Arizona and New Mexico; the species does not seem to remain through the winter in northern Texas, but at this season it is found in southern Illinois, Pennsylvania, the coast of Massachusetts, and even to Maine. During the winter the ruddy duck has been recorded in the Bermudas, the Bahamas (New Providence), Jamaica, Martinique, Grenada, Barbados, and once in Central America—outside of Guatemala—at Irazu, Costa Rica. From the Chesapeake Bay to Florida it is quite a common winter resident, though it is being rapidly diminished in numbers.

Spring migration.—The ruddy duck is rather a late migrant. Throughout its winter district, northward movements occur late in March, and just north of this region it appears early in April. Average dates of arrival are: Erie, Pa., April 16; Oberlin, Ohio, April 15 (earliest April 7, 1903); Heron Lake, Minn., April 10 (earliest April 3, 1889); eastern Nebraska, April 7; Cheyenne, Wyo., April 21; southern Manitoba, May 5 (earliest, April 26, 1891). The first migrant was seen at Osler, Saskatchewan, May 7, 1893, and at Fort Keogh, Mont., April 21, 1889.

Fall migration.—An excellent series of observations at Alexandria, Va., extending over sixteen years, fixes September 30 as the average date of arrival on the Potomac (earliest, August 20, 1889). The average date when the species becomes common is October 25. On the Massachusetts coast the ruddy duck is most common in October and November. Farther west in the same latitude migration is somewhat earlier, and the northern States, from Pennsylvania to Minnesota, are deserted the first half of November. The first date of arrival at Barbados is September 13, 1887.

Nomonyx dominicus (Linn.). Masked Duck.

This is a tropical species that lives principally in the West Indies and in eastern South America. It is common in Argentina to the Rio Negro and north through eastern and central Brazil to Guiana, Venezuela, and the islands of Trinidad, Barbados, St. Croix, Porto Rico, Haiti, Jamaica, and Cuba. This may be considered the regular range. In western South America the masked duck has been noted at Concepcion, Chile, both in June and September, 1894—this is directly west of its center of abundance in Argentina—at Tatarenda, in eastern Bolivia, and Lake Titacaca, in the western part; at Sarayacu and the river Peripa, in Ecuador; twice in Panama, once in Guatemala, and four times in Mexico (Orizaba, Jalapa, Matamoras, Escuinapa). Just across the river from Matamoras, at Brownsville, Tex., is the only place in the United States where it has been found that it seemed to be at home. As it was noted July 22, 1891, it probably breeds there. Strays have been found in Vermont (Alburg Springs, September 26, 1857), Wisconsin (near Newville, November, 1870), Massachusetts (Malden, August 27, 1889), and Maryland (Elkton, September 8, 1905).

The species is not strictly nonmigratory, but the data are insufficient to allow of exact statements concerning its migration.

DISTRIBUTION AND MIGRATION OF GEESE.

Chen hyperborea (Pall.). Lesser Snow Goose.

Breeding range.—Much remains to be learned of the boundaries of the summer home of the snow geese. "Vast numbers" of this goose were seen on the northwestern portion of Banks Land, latitude 74°, August 19, 1851, as though they had come from more northern breeding grounds, and in the spring of 1851 and 1852 flocks were seen passing north in the vicinity of the northern shores of this island; and yet no snow geese have been reported by any of the various expeditions that have summered on the islands immediately to the north of Banks Land. Snow geese are known to breed along the Arctic coast east of the Mackenzie River and to cross to Victoria Land, but here the record ends. Wollaston Land and Victoria Land form an enormous island whose interior has never been visited by white men. Many explorers have passed through the region to the northward, but no one has reported a snow goose in the whole district east of longitude 115° and north of latitude 70°, with the exception of a single flock seen near Bellot Strait in June, 1859, and three wanderers found in June, 1882, at Fort Conger, a thousand miles north of the regular range. Ross lived for three years at the base of the Boothia Peninsula without seeing a snow goose. Parry found but few birds and only one nest during his two years' sojourn on Melville Peninsula, and Kumlein reports them as rare visitants at Cumberland Sound. It follows, therefore, by exclusion, that the great bulk of the snow geese breed south of a line drawn from the north end of Southampton Island to the south end of Melville Island. It is supposed that the lesser snow goose is the form breeding at the mouth of the Mackenzie River, and east to about longitude 115°. It follows, therefore, that the greater snow goose is restricted in its breeding range to the district from Melville Peninsula to Victoria Land, an area perhaps half as large as Greenland, as yet scarcely visited by an ornithologist.

The most western breeding place of the lesser snow goose is Richards Island, on the eastern side of the mouth of the Mackenzie River; thence it ranges eastward to about Coronation Gulf. There seem to be two routes by which the snow geese reach their summer home. They are common in winter in California; indeed, this seems to be their principal winter abode. In the spring migration some continue up the coast to Alaska, but all observers agree that they are not common in Alaska during the spring migration. On the other hand, the species is an abundant migrant along the Mackenzie at Fort Simpson, just south of the breeding grounds, and the flocks in spring fly at a great height on their course toward the north. This is just the route the snow geese would take from California to their breeding grounds if they migrate by the most direct route. Though occurring accidentally in northern Europe and found on the Arctic coast of northeastern Asia, sometimes in considerable numbers, the lesser snow goose is not, as yet, known to breed in the Eastern Hemisphere.

Winter range.—Both forms of the snow goose occur during the winter season in the lower Mississippi Valley. It seems probable that in this district the Mississippi River is the approximate dividing line between the two forms, to the westward *C. hyperborea* being the more common, to the eastward, *C. nivalis.* Both forms winter as far north as southern Illinois, and the lesser snow goose is abundant in winter in Louisiana and Texas, and ranges south in Mexico to Guanajuato and Jalisco, and rarely to northern Lower California. It winters sparingly in southern Colorado, more commonly in Utah, abundantly in Nevada, and along the Pacific coast from southern California (Orange County) to southern British Columbia. On the Asiatic side it winters south to Japan.

Spring migration.—Writing many years ago, Ross states that the lesser snow goose arrives at Great Slave Lake earlier than the greater. Recent records of spring migration confirm this statement, and our present knowledge of isothermal lines affords a satisfactory explanation. It is considered that the common species in eastern North Dakota is *C. nivalis*, while the bird of Montana is *C. hyperborea.* Long-continued observations in the valley of the Red River of the North indicate that the first *C. nivalis* arrive on the average at latitude 47° on April 15; at the same latitude in central Montana the first migrants of *C. hyperborea* appear April 6. The more eastern birds advance to Aweme, Manitoba, latitude 50°, April 22, while at this latter date the van has reached Edmonton, Alberta, latitude 54°. Yet these more western and northern birds (lesser snow geese) are actually traveling in warmer weather than their eastern relations migrating at a later date; for during the last third of April the temperature at Edmonton averages about 2 degrees warmer than at Aweme.

Further advance of the lesser snow goose is recorded during the spring of 1904 to Fort Vermilion, latitude 58°, April 26, and to Fort Simpson, latitude 62°, May 2. East of Fort Simpson at Southampton Island, in Hudson Bay, this same spring the first snow geese were not seen until thirty-three days later—June 4—while to the westward, at Point Barrow, Alaska, more than 500 miles farther north, the first lesser snow geese arrive just about the same time as at Fort Simpson. The lesser snow geese that reach their breeding grounds by way of Alaska probably winter at least 800 miles farther north than those of the Mississippi Valley, and spring opens on the Pacific coast much earlier than in the interior.

The most northern records of the lesser snow goose are on Banks Land, where it arrived at Princess Royal Islands, latitude 73°, May 31, 1851, and at Mercy Bay, latitude 74°, May 31, 1852. The average rate of migration from central Montana, April 6, to Mercy Bay, May 31, is 33 miles per day.

During spring migration there is much difference in the length of time spent at different points of its route. In northern Texas the first appear March 4 and the last leave April 6, each being average dates; the extremes are February 18, 1887, and April 12, 1895; in other words, the snow goose is usually thirty-three days in passing northern Texas, and may linger fifty-four days. At the northern boundary of the United States, these periods are reduced about one-third, while still farther north near Lake Athabasca the species was present in 1901 for at least fourteen days, in 1903 for fifteen days, and at Fort Simpson in 1904 for twenty-three days. They arrive on the shore of Norton Sound, Alaska, from May 5 to 15, and at Nulato, on the Yukon, about May 9.

Fall migration.—Early migrants of the lesser snow goose were noted at Parry Bay, latitude 72°, August 13, 1821; at Point Barrow, latitude 70°, August 15, 1883; at Darnley Bay, latitude 69°, August 17, 1848; St. Michael, latitude 64°, September 2, 1878; Terry, Mont., latitude 47°, September 12, 1904; Stockton, Cal., latitude 38°, about September 29; central Texas, latitude 31°, about October 11. These dates indicate that the most northern breeders do not remain so long as ten weeks on the breeding grounds, and that they occupy fifty-eight days in retracing the path that required sixty-eight days during the spring migration.

The last seen on Banks Land were noted September 7, 1850; near Fort Norman, October 3, 1903; at mouth of the Yukon, about October 10; ten days later the last cross the boundary of the United States to the Mississippi watershed and desert central Nebraska about the first week in November.

Chen hyperborea nivalis (Forst.). Greater Snow Goose.

Breeding range.—The greater snow goose is enormously abundant on both the eastern and the western shores of Hudson Bay during spring migration, and these birds might be supposed to pass from these points approximately north to their breeding grounds. If such is the case it is somewhat strange that they have never been found breeding on any of the northern islands; nor have they been noted in migration anywhere north, northeast, or east of Hudson Bay, except the few seen at Igloolik, a few noted by Kumlein in Cumberland Bay, some stragglers that have wandered to the west coast of Greenland, and three birds seen by Greeley's party June 12–13, 1882, in Grinnell Land, latitude 82°. As already stated in connection with the lesser snow goose, it is probable that these Hudson Bay geese eventually turn to the northwestward and breed for the most part on Victoria Land.

Winter range.—During winter the greater snow goose has occurred in Cuba, Isle of Pines, Jamaica, and Porto Rico. Sometimes it has appeared in Cuba in quite large numbers. It is not usually common anywhere south of North Carolina. On this coast and as far as Chesapeake Bay it is not rare; a few are found in winter even as far north as Massachusetts. There is no sharply-defined line in the Mississippi Valley between the winter ranges of the greater and the lesser forms. In general the greater snow goose is the more common east of the Mississippi River, and winters from southern Illinois to the Gulf.

Spring migration.—Throughout North America, north of Virginia and east of the immediate vicinity of Hudson Bay, the greater snow goose is a rare visitant; most of the spring dates in this region fall between March 20 and April 10. In the Mississippi Valley migration begins in February, and the first migrants appear north of the winter range early in March; the average date of arrival in central Iowa is March 22, and in northern Iowa March 26; southern Minnesota is reached April 6, southern Manitoba April 22, and in 1904 the first were noted in northern Hudson Bay June 4. The last leave the Gulf coast about the 1st of April; the average date for eleven years of the last seen at Aweme, Manitoba, is May 15, and the latest date May 20, 1903.

Fall migration.—One of the earliest dates of arrival of this species in New England is October 2, 1896, at Lake Umbagog; there are a few other October dates for New England. About the middle of October the earliest migrants appear on Chesapeake Bay, and the last of the month they arrive in Cuba and have been recorded in the Bermudas. In the fall the average date of arrival at Aweme, Manitoba, is September 28, and the earliest September 24, 1901; central Iowa is reached October 17, and the Gulf coast the last of the month. The average date of the last seen in the fall at Aweme, Manitoba, is October 20 (latest October 31, 1900).

Chen cærulescens (Linn.). Blue Goose.

Breeding range.—According to reports of Indians the blue goose nests in the interior of northern Ungava, but the nest and eggs are unknown to science, and there is no record of the presence of the birds anywhere in summer. During migration the species has been noted as an occasional visitant as far west as the western shore of Hudson Bay in the vicinity of Fort Churchill and east to New Hampshire.

Winter range.—The lower portion of the Mississippi Valley, principally west of the river, seems to be the winter home of this rather rare goose. It is not uncommon on the Gulf coast of Louisiana and Texas, and north to Nebraska and southern Illinois. It has occurred rarely or casually to the eastward in the Bahamas (Inagua), Cuba, Florida (Tortugas); North Carolina (near Fort Macon); Pennsylvania (near Pittsburg, 1887); New Jersey, New York (Shinnecock Bay, Long Island); Rhode Island (Newport, October 16, 1892); Massachusetts (Gloucester, October 20, 1876); New Hampshire (Lake Umbagog, October 2, 1896); Ohio (Oberlin, October 28, 1896; Columbus, October 28, 1876); Ontario (Ottawa, October 11, 1886; Gravenhurst, 1886). Apparently the only record west of the Rocky Mountains is that of two taken near Stockton, Cal., about February 1, 1892.

Spring migration.—Not many notes on the migration of this species are available. The few records indicate that the van moves across the central Mississippi Valley during the latter half of March and crosses to Manitoba the last of April or early May.

The blue goose seems to be exceptional in the selection of its migration route. The general trend of migration among waterfowl in North America is northwest and southeast. The blue goose apparently breeds entirely east of Hudson Bay and winters for the most part west of the Mississippi River, so that its spring migration flight is toward the northeast, across at least 20 degrees of longitude. At this season the large flocks pass north along the eastern side of James Bay, these flocks occasionally containing a few snow geese; while the enormous flocks of the latter that migrate north along the west side of James Bay are accompanied by a few blue geese.

Fall migration.—The above dates of occurrences outside of the normal range show that the fall migration is chiefly southward across the eastern United States and that it occurs in October.

Chen rossii (Cassin). Ross Snow Goose.

Breeding range.—The nest and eggs of this goose are still unknown, and there is no summer record of the species. The westernmost arctic locality known is Fort Anderson, and it ranges thence east to Hudson Bay. It is rare at each of these extremes, and the natural supposition is that the breeding grounds are to the north of the intervening district, that is, between the meridians of 100° and 120° west longitude. Observations on the birds of this region have been made by several observers, but they seem not to have distinguished this small white species from the larger snow goose.

Winter range.—The present known winter home of the Ross goose is California, where it occurs along the coast south to Orange County (Newport), and north to Stockton and the San Joaquin Valley. One was taken at Comox, British Columbia, January, 1894, but this occurrence was probably accidental. A pair was seen and one taken at Bustillos Lake, Chihuahua, also probably accidental.

Migration range.—The path of migration of this goose seems to be different from that of any other species. It is a fair presumption that the principal route coincides with the districts in which the species is most common. The greater number pass from the breeding grounds to Great Slave Lake and Lake Athabasca, continue south to central and western Montana, and then turn southwest, cross the Rocky Mountains, and pass to central and southern California.

Spring migration.—Records that are in close agreement indicate that the average date of arrival in spring at Great Falls, Mont., is April 7, and at Columbia Falls, Mont., April 8. The average date at which the last one was seen in central Montana is April 24. The birds were noted on the lower Athabasca River May 31, 1903, and one was taken May 25, 1865, at Fort Anderson, near the Arctic coast. The latest spring records are of its occurrence at Lake Athabasca, June 3, 1903, and at the base of Kent Peninsula, Arctic coast, June 2, 1902. The record of one taken near Camp Harney, Oreg., April 12, 1876, seems to be the only one for that State. A few have been taken in southern British Columbia at Shuswap Lake, Kuper Island, and the mouth of the Fraser River; one was taken at Fort Keogh, Mont., April 25, 1892.

Fall migration.—The returning flocks have been recorded at Great Slave Lake, September 1, 1893, at Columbia Falls, Mont., October 10, 1893, and at Newport, Cal., November 10, 1900. The average date of arrival at Columbia Falls, Mont., is October 15, and the latest date October 28, 1896. A straggler was taken at Winnipeg, Manitoba, September 20, 1902.

Anser albifrons (Gmel.). White-fronted Goose.

The typical species inhabits Europe and Asia, and is reported as having been taken in May and September at Angmagsalik and Tasinsak in eastern Greenland.

Anser albifrons gambeli (Hartl.). American White-fronted Goose.

Breeding range.—This goose breeds on the shore of the mainland from the mouth of the Yukon around the north side of Alaska and east to Lake Beechey on Back River; also coastwise for a few miles back in northern Mackenzie, and up the Yukon at least as far as Fort Yukon. The birds seen by Preble at Fort Wrigley, on the Mackenzie, July 23, 1904, may or may not have been breeding; a few nest on the coast of northeastern Asia in the vicinity of Bering Strait.

In giving the above range no mention is made of the birds that breed on the west coast of Greenland, where the species is not uncommon. It is evident from Labrador and Atlantic coast records that Greenland birds do not come to the southwest; hence they probably go to the southeast, and should be classed as European birds.

Winter range.—The white-fronted goose winters in the whole southern half of the United States and south to Cuba and northern Mexico.

Along the whole Atlantic slope it is rare; formerly, perhaps, it was not uncommon, but at present it is hardly more than an occasional winter visitant north to the coast of New Jersey, and an accidental migrant to New England, thence north to Labrador, where it has only once been recorded. It is not common in the interior east of the Mississippi River, and winters from the Gulf to southern Illinois and southern Ohio. The species is somewhat more common in migration along the eastern portion of the plains, wintering in southern Texas and more commonly in northern Mexico. The principal winter home is on the Pacific slope from Cape St. Lucas, Lower California, and Lake Chapala, Jalisco, to southern British Columbia. The few Asiatic birds winter on the coasts of China and Japan.

Spring migration.—The average date when the first migrants reach central Nebraska is March 9; Keokuk, Iowa, March 19; Aweme, Manitoba, April 18 (earliest April 6, 1905); Indian Head, Saskatchewan, April 22; Fort Vermillion, Alberta, April 27, 1904; Fort Resolution, Mackenzie, May 7, 1860; Fort Simpson, May 11, 1904; Fort Enterprise, May 17, 1821; Fort Anderson, May 16, 1864, May 17, 1865; Coronation Gulf, May 31, 1851.

On the Pacific slope migration is somewhat earlier; the first appear at St. Michael, Alaska, April 25 to May 10; at Nulato, May 6–10; Kowak River, May 10, 1899; Point Barrow, May 16, 1882, May 25, 1883. During the second half of April the last migrants leave the region south of Iowa and Nebraska; the average of the last seen at Aweme, Manitoba, for six years is May 11, and the latest May 17, 1898; the last leave California the first week in May. The first eggs were found near the mouth of the Yukon May 27, 1879; downy young were seen on the Kowak River June 24, 1899.

Fall migration.—Adults begin to leave the most northern breeding grounds by the middle of July, but so slow is the movement southward that on the average the first do not appear in southern Manitoba until September 26 (earliest September 7, 1902), and they reach the winter home, Louisiana to Texas, about the middle of October. At the same time the earliest of the fall migrants appear in central California, but the main flight does not arrive before November. The species has been noted at Stockton, Cal., as early as September 7. The last was noted at Point Barrow, Alaska, August 18, 1882; at the Kowak River, September 12, 1898; at St. Michael about October 7, and near Fort Wrigley, Mackenzie, October 9, 1903. The average date when the last are seen at Aweme, Manitoba, is October 13, and the latest was November 3, 1899.

Anser fabalis (Lath.). Bean Goose.

An Old World species of accidental occurrence (once) in northern Greenland.

Branta canadensis (Linn.). Canada Goose.

Breeding range.—The principal summer home of the Canada goose is the interior of Canada, from Saskatchewan and Alberta north to the limit of trees. Eastward it breeds commonly in the interior of Ungava and rarely on the coast as far north as Okak and Ungava Bay. It is not a rare breeder in Newfoundland, and is fairly common on the islands of the Gulf of St. Lawrence and thence west through Quebec and northern Ontario to the southern end of James Bay. Any occurrences south of this district must be considered accidental or casual, though it has been recorded as nesting at Lexington, Mass., April, 1888, and once at Hartland, Vt.

In the interior of North America the breeding range extends somewhat farther south. A hundred years ago the species bred commonly in all the northern third of the Mississippi Valley and not uncommonly to the latitude of St. Louis. Now the number of pairs breeding south of the latitude of central Iowa is very small, though even of late years the Canada goose has been known to breed at Samburg and at Reelfoot Lake, Tennessee, which seem to be the most southern localities known east of the Rocky Mountains. A few breed in Kentucky, and the number increases slightly in Indiana and Illinois and the southern third of Michigan and Wisconsin. North of this and throughout much of Minnesota the species is a regular and not uncommon summer resident. The Canada goose formerly bred in Kansas; now it breeds rarely in Nebraska and southern South Dakota; regularly in North Dakota and northward. The species still breeds in the northern third of Colorado, in northern Utah, northern Nevada, southern Oregon and northward. A half century ago it was recorded as breeding as far south as southern New Mexico. The western boundary of the breeding range extends from the interior of British Columbia to the upper Yukon and to Fort Yukon, with a few stragglers west to the Yukon mouth.

Winter range.—The principal winter home is the southern half of the Mississippi Valley west of the Mississippi River, but the species is not rare in the eastern United States from Florida to Maryland, occasionally to Massachusetts, and is recorded during the winter in Maine, Nova Scotia, Quebec, and even in Newfoundland. The normal winter range in the interior extends to southern Indiana and southern Illinois, but a few have been noted in winter in Ohio, southern Ontario, southern Michigan, southern Wisconsin, Nebraska, southern Colorado, and southern Utah. The winter home includes all of the Pacific coast region north to British Columbia, but in California typical *B. canadensis* inhabits the interior rather than the seashore. The Canada goose is an accidental visitant to the Bermudas and to the West Indies (Jamaica and probably St. Croix).

Spring migration.—More records on the movements of the Canada goose have been contributed than on any other three waterfowl combined. A synopsis of the most important of these notes is presented, both for the purpose of indicating the time of the principal migration movements and also of calling attention to the wide differences in the records from contiguous localities in the case of a locally distributed species like the goose.

Dates of arrival in spring of the Canada goose.

ATLANTIC COAST.

Place.	Number of years' record.	Average date of spring arrival.	Earliest date of spring arrival.
Central Maryland	6	Mar. 22	Feb. 15, 1892
Berwyn, Pa	5	Mar. 5	Feb. 18, 1901
Renovo, Pa	3	Mar. 15	Mar. 12, 1899
Hares Valley, Pa	5	Mar. 12	Feb. 19, 1887
Central Pennsylvania	19	Mar. 17	Feb. 13, 1892
Erie, Pa	4	Mar. 21	Mar. 2, 1902
Central New Jersey	16	Mar. 22	Feb. 4, 1890
Oak Orchard Light, New York	9	Mar. 18	Mar. 4, 1890
Montauk Point, Long Island	8	Feb. 24	Feb. 15, 1893
Shelter Island, Long Island	8	Mar. 14	Mar. 10, 1892
Central New York	20	Mar. 13	Jan. 31, 1890
Plattsburg, N. Y	....	Mar. 22	Mar. 17, 1886
Jewett City, Conn	11	Mar. 19	Mar. 2, 1902
Central Connecticut	17	Mar. 17	Feb. 1, 1890
Block Island Light, Rhode Island	11	Mar. 16	Feb. 21, 1898
Framingham, Mass	8	Mar. 26	Mar. 20, 1887
Central Massachusetts	19	Mar. 17	Feb. 25, 1888
St. Johnsbury, Vt	3	Mar. 21	Mar. 13, 1902
Northern Vermont	6	Mar. 23	Mar. 13, 1902
Southern New Hampshire	13	Mar. 21	Mar. 11, 1892
Southern Maine	15	Mar. 24	Mar. 5. 1902
Plymouth, Me	9	Apr. 1	Mar. 23, 1880
Quebec City, Canada	12	Mar. 27	Mar. 1, 1894
Montreal, Canada	6	Mar. 22	Feb. 15, 1893
Godbout, Quebec	3	Apr. 8	Apr. 5, 1887
Grand Manan, New Brunswick	5	Mar. 22	Mar. 1, 1890
Chatham, New Brunswick	6	Mar. 19	Mar. 1, 1902
Scotch Lake, New Brunswick	5	Mar. 20	Mar. 14, 1902
Pictou, Nova Scotia	9	Mar. 7	Feb. 26, 1889
Halifax, Nova Scotia	5	Mar. 13	Feb. 23, 1892
North River, Prince Edward Island	4	Mar. 20	Mar. 9, 1888
Alberton, Prince Edward Island	8	Mar. 19	Mar. 10, 1889

MISSISSIPPI VALLEY.

Place.	Number of years' record.	Average date of spring arrival.	Earliest date of spring arrival.
Central Missouri	8	Feb. 11	(a)
Batavia, Ill	6	Feb. 22	Feb. 14, 1888
Chicago, Ill	18	Mar. 14	Jan. 15, 1897
Odin, Ill	5	Feb. 22	(a)
Lafayette, Ind	4	Mar. 2	Feb. 23, 1895
Bloomington, Ind	3	Mar. 5	Feb. 17, 1903
New Harmony, Ind	3	Feb. 8	Feb. 2, 1902
Frankfort, Ind	10	Feb. 19	Feb. 12, 1893
Waterloo, Ind	8	Mar. 14	Feb. 4, 1890
Sedan, Ind	6	Mar. 11	Feb. 13, 1891
Oberlin, Ohio	6	Mar. 9	Feb. 19, 1905
Wauseon, Ohio	4	Mar. 16	Feb. 23, 1888
Weymouth, Ohio	4	Mar. 13	Mar. 11, 1885
Petersburg, Mich	5	Mar. 5	Feb. 13, 1890
Battle Creek, Mich	5	Mar. 13	Mar. 8, 1903
Southern Michigan	19	Mar. 14	Feb. 23, 1890
Ottawa, Ontario	11	Apr. 4	Mar. 20, 1903
Southern Ontario	10	Mar. 16	Feb. 24, 1901
Southern Iowa	16	Mar. 1	Feb. 4, 1890
Storm Lake, Iowa	4	Feb. 17	Feb. 2, 1888
Spirit Lake, Iowa	7	Mar. 1	Feb. 23, 1886
Delavan, Wis	3	Mar. 4	Feb. 28, 1895
Southern Wisconsin	18	Mar. 13	Feb. 27, 1894
Heron Lake, Minn	4	Mar. 18	Feb. 23, 1886
Lanesboro, Minn	3	Mar. 21	Mar. 15, 1889
St. Paul, Minn	3	Mar. 22	Mar. 5, 1889
Elk River, Minn	4	Mar. 27	Mar. 11, 1885
Onaga, Kans	7	Feb. 14	(a)

[a] A few winter.

Dates of arrival in spring of the Canada goose—Continued.

MISSISSIPPI VALLEY—Continued.

Place.	Number of years' record.	Average date of spring arrival.	Earliest date of spring arrival.
Central Kansas	4	Feb. 13	(a)
Southern Nebraska	6	Feb. 21	(a)
Omaha, Nebr	4	Feb. 26	Feb. 12, 1898
Huron, S. Dak., and vicinity	6	Mar. 17	Mar. 2, 1889
Grand View, S. Dak., and vicinity	5	Feb. 23	Jan. 27, 1891
Argusville, N. Dak	6	Mar. 23	Mar. 8, 1892
Larimore, N. Dak	8	Mar. 21	Mar. 16, 1894
Aweme, Manitoba	11	Mar. 29	Mar. 9, 1905
Reaburn, Manitoba	9	Apr. 2	Mar. 25, 1900
Qu'Appelle, Saskatchewan	3	do	Mar. 25, 1905
Bulyea, Saskatchewan			Apr. 10, 1904
Indian Head, Saskatchewan	2	Apr. 1	Feb. 24, 1905
Fort Vermillion, Alberta			Apr. 15, 1904
Reindeer Lake, Saskatchewan	16	Apr. 30	Apr. 17, 1889
Fort Simpson, Mackenzie	14	Apr. 28	Apr. 22, 1904
Rathdrum, Idaho	2	Feb. 24	Feb. 3, 1901
Great Falls, Mont	3	Mar. 12	Mar. 10, 1889
Columbia Falls, Mont	5	Mar. 24	Mar. 17, 1895
Terry, Mont	10	Mar. 27	Feb. 28, 1892

[a] A few winter.

Dates of departure in spring of the Canada goose.

Place.	Number of years' record.	Average date of last one seen.	Latest date of last one seen.
Central West Virginia	3	Apr. 1	Apr. 21, 1886
Central Maryland	5	Apr. 4	Apr. 22, 1890
Berwyn, Pa	4	Apr. 11	Apr. 24, 1898
Renovo, Pa	3	Apr. 15	Apr. 16, 1900
Central Pennsylvania	10	Apr. 9	May 5, 1894
Central New Jersey	6	Apr. 16	May 9, 1887
Oak Orchard Light, New York			May 14, 1890
Montauk Point Light, Long Island	11	Apr. 22	Apr. 29, 1890
Southern Mississippi	4	Mar. 26	Apr. 20, 1903
Keokuk, Iowa	6	Apr. 3	Apr. 23, 1893
Grapevine, Tex	11	Apr. 4	Apr. 15, 1899
Northern Texas	7	Apr. 4	Apr. 9, 1885

Spring arrival of the Canada goose.

Year.	Central Missouri.	Frankfort, Ind.	Southern Iowa.	Chicago, Ill.	Southern Wisconsin.	Southern Michigan.
1884	Feb. 1			Mar. 15	Mar. 16	Mar. 15
1885			Mar. 2	Mar. 29	Mar. 28	Mar. 27
1886	Feb. 10		Feb. 23	Mar. 17	Mar. 16	Mar. 12
1887			Feb. 28	Mar. 12	Mar. 6	Mar. 8
1888			Mar. 1	Mar. 18	Mar. 15	Mar. 14
1889	Feb. 11	Feb. 15	Mar 2	Mar. 7	Mar. 15	Mar. 18
1890			Feb. 26		Mar. 19	Mar. 7
1891				Mar. 2		Mar. 10
1892			Feb. 26		Mar. 4	Mar. 5
1893	Feb. 4	Feb. 12	Feb. 26	Mar. 12	Mar. 10	Mar. 5
1894		Feb. 14	Mar. 1	Mar. 9	Mar. 3	Mar. 16
1895		Feb. 25		Mar. 13	Mar. 12	Mar. 25
1896		Feb. 21	Feb. 25	Mar. 6	Mar. 8	
1897		Feb. 14		Mar. 16	Mar. 19	Mar. 8
1898		Feb. 17	Mar. 5	Mar. 10	Mar. 9	
1899		Feb. 20		Mar. 21		
1900		Feb. 21	Feb. 28	Mar. 13		Mar. 26
1901		Feb. 27		Mar. 16		Mar. 27
1902	Feb. 11		Feb. 28	Mar. 19	Mar. 9	Mar. 14
1903	Feb. 10		Mar. 1	Mar. 13	Mar. 17	Mar. 8
1904	Feb. 20		Feb. 29		Mar. 13	Mar. 8
1905	Feb. 22		Feb. 26		Mar. 18	Mar. 11
Average	Feb. 11	Feb. 19	Mar. 1	Mar. 14	Mar. 13	Mar. 14

Spring arrival of the Canada goose—Continued.

Year.	Southern Ontario.	Ottawa, Ontario.	Larimore, N. Dak.	Aweme, Manitoba.	Reaburn, Manitoba.	Terry, Mont.
1884	Mar. 13			Apr. 1		
1885	Mar. 25		Apr. 3			
1886			Mar. 22			
1887						
1888	Mar. 19					
1889	Mar. 12		Mar. 16			
1890	Mar. 12	Mar. 28	Mar. 24	Mar. 20		Mar. 27
1891						
1892						
1893		Apr. 8				Apr. 2
1894		Apr. 12	Mar. 16		Apr. 7	Mar. 18
1895	Mar. 26	Apr. 12	Mar. 22			
1896		Apr. 10		Mar. 26	Mar. 28	Mar. 27
1897	Mar. 12	Mar. 31		Apr. 7	Apr. 8	Apr. 4
1898	Mar. 14	Mar. 29		Apr. 7	Apr. 7	Apr. 3
1899		Apr. 8		Apr. 9	Apr. 10	
1900	Mar. 13	Apr. 5		Mar. 23	Mar. 25	Mar. 25
1901				Mar. 28	Apr. 2	
1902				Mar. 14	Mar. 27	
1903				Mar. 28	Mar. 27	Apr. 1
1904		Mar. 26	Mar. 24	Mar. 30		Mar. 22
1905	Mar. 19	Mar. 31	Mar. 24			Mar. 20
Average	Mar. 16	Apr. 4	Mar. 21	Mar. 29	Apr. 2	Mar. 27

The Canada goose is about the earliest water bird to migrate in spring, and throughout the whole course of its journey from its winter home to the Arctic coast it keeps close to the melting ice and the opening streams. The following dates seem a fair average for the time of arrival in the several districts:

Locality.	Latitude.	Date.
	° ′	
Southeastern Iowa	40 30	Feb. 20
Southern Minnesota	44 00	Mar. 19
Central Minnesota	46 00	Mar. 28
Southern Manitoba	50 00	Apr. 6
Alberta	58 00	Apr. 22
Southern Mackenzie	62 00	May 3
Northern Mackenzie	66 00	May 12

If the time occupied in passing from one district to the next is compared with the distance traveled, it will be found that the speed varies widely in different parts of the migration route. The following are approximate averages:

From latitude 40° to latitude 44°, 9 miles per day.
From latitude 44° to latitude 46°, 15 miles per day.
From latitude 46° to latitude 50°, 20 miles per day.
From latitude 50° to latitude 58°, 23 miles per day.
From latitude 58° to latitude 62°, 25 miles per day.
From latitude 62° to latitude 66°, 30 miles per day.

A great many records of the spring arrival of the Canada goose at the posts of the Hudson's Bay Company are available. Since this bird forms an important part of the food, both of the Indians and of the company's employees, a record is kept of its arrival each spring, and a reward is given to the person that secures the first one. These records show that the Canada goose is among the most variable of birds in the time of its arrival. This is natural, since its migration seems to depend almost wholly upon the presence of open water, and this varies much with the seasons. The record at Fort Simpson covers thirteen years between 1881 and 1894, and the average date of arrival is April 28, with extremes of fifteen days from April 23 to May 8. The average variation—the "probable error"—in time of arrival is 4.1 days, i. e., if the Canada goose is noted as arriving on a certain date in any one year at that latitude the probability is that this date is within 4.1 days of the average date of arrival at that locality. At Lac du Brochet Post, on Reindeer Lake, Saskatchewan, the following are the dates when the first Canada goose was seen:

1874	May 5	1880	May 5	1886	Apr. 23
1875	May 11	1881	May 4	1887	May 3
1876	May 8	1882	May 3	1888	May 7
1877	Apr. 27	1883	Apr. 25	1889	Apr. 17
1878	Apr. 19	1884	May 3		
1879	Apr. 24	1885	Apr. 29		

The average date of arrival is April 30, with extremes of twenty-four days from April 17 to May 11. The average variation is 5.9 days.

Eggs have been found in northern Indiana, southern Minnesota, and central Wyoming the first week in May, and sometimes even in April, and at Malheur Lake, Oregon, April 24. An early set was found May 4 near the Saskatchewan, and one May 11 near the Red Deer River, Alberta, but usually nesting in this district begins about the middle of May, and at the northern limit of the range not much before the middle of June.

Dates of arrival in the fall of the Canada goose.

Place.	Number of years' record.	Average date of first one seen.	Earliest date of first one seen.
Prince Edward Island	8	Aug. 28	Aug. 22, 1889
Scotch Lake, New Brunswick	3	Oct. 23	Oct. 21, 1902
Central Massachusetts	5	Oct. 11	Sept. 4, 1889
Block Island, Rhode Island	7	Oct. 21	Sept. 27, 1898
Montauk Point, Long Island	9	Oct. 20	Sept. 30, 1888
Renovo, Pa	4	Oct. 24	Oct. 7, 1904
Central Pennsylvania	8	Oct. 22	Oct. 15, 1894
Central New Jersey	14	Oct. 18	Sept. 23, 1897
Alexandria, Va	16	Oct. 20	Oct. 5, 1888
Atlantic, N. C			Oct. 20, 1899
Anderson, S. C			Oct. 10, 1902
Chipley, Fla			Oct. 8, 1902
Aweme, Manitoba	6	Aug. 14	Aug. 3, 1901
Central South Dakota	3	Sept. 23	Aug. 20, 1890
Northern Nebraska	7	Oct. 7	Sept. 7, 1888
Onaga, Kans	4	Oct. 18	Oct. 3, 1894
Grapevine, Tex	9	Oct. 9	Sept. 30, 1904
Central Wisconsin	8	Oct. 12	Sept. 30, 1892
Central Iowa	7	Oct. 14	Sept. 16, 1899
Keokuk, Iowa	8	Oct. 8	Sept. 27, 1895
Wauseon, Ohio	4	Oct. 20	Oct. 10, 1887
Central Indiana	5	Oct. 19	Oct. 6, 1902
Northern Illinois	4	Oct. 13	Sept. 28, 1895
Central Missouri	4	Oct. 4	Sept. 23, 1900
Helena, Ark	3	Oct. 4	Sept. 26, 1896
Southern Mississippi	2	Nov. 12	Nov. 5, 1902

Dates of departure in the fall of the Canada goose.

Place.	No. of years' record.	Average date of last one seen.	Latest date of last one seen.
Columbia Falls, Mont	4	Nov. 20	Nov. 24, 1895
Aweme, Manitoba	6	Nov. 17	Dec. 2, 1899
Southern Ontario	4	Nov. 7	Nov. 10, 1901
Southern Michigan	4	Nov. 8	Nov. 25, 1890
Central Minnesota	8	Nov. 9	Dec. 1, 1890
Central Iowa	13	Nov. 18	Dec. 26, 1904
Keokuk, Iowa	7	Nov. 10	Dec. 4, 1900
Central Nebraska	4	Nov. 27	(a)
Prince Edward Island	6	Dec. 1	Dec. 22, 1889
Grand Manan, New Brunswick	4	Nov. 15	Nov. 20, 1890
Montreal, Canada	4	Nov. 4	Nov. 14, 1896
Southern Massachusetts	8	Nov. 18	Dec. 28, 1877
Mantauk Point, Long Island	8	Nov. 21	Dec. 19, 1889
Renovo, Pa	6	Nov. 9	Nov. 18, 1903
Central Pennsylvania	7	Nov. 14	Dec. 6, 1899
Berwyn, Pa	6	Nov. 16	Dec. 15, 1891
Central New Jersey	9	Nov. 19	Dec. 10, 1902

[a] A few winter.

Branta canadensis hutchinsii (Rich.). Hutchins Goose.

Breeding range.—This is the most northern of the several forms of Canada goose and nests from Melville Peninsula north to latitude 70° and west along the shores and islands of the Arctic coast to the mouth of the Mackenzie and through the interior of Alaska to the Kowak River. Apparently it does not breed in the interior of North America south of the Barren Grounds, but on the Pacific coast it breeds in the valley of the Kowak River and south to the mouth of the Knik River; also abundantly in the western Aleutians and on the Near Islands. One was taken June 10 at Kingwah Fjord and a few have been taken at Disco and Godhaven, Greenland, but there seems to be no breeding record east of Hudson Bay.

Winter range.—The Hutchins goose seems to be more common in California during the winter season than elsewhere, though it is not rare in the rest of the southern United States west of the Mississippi River. Its normal eastern range is to Hudson Bay, Illinois, and Louisiana. It is known as a rare migrant in Maine and a century ago seems to have been not uncommon on the New England coast. A few pass through western New York, Ontario, and Ohio, and less rarely through Indiana. Southern Wisconsin seems to be the farthest north that it has been recorded in the interior during the winter season. It appears to be unknown on the Atlantic coast south of Virginia, but on the Pacific it passes south to San Rafael, Lower California, and probably to Lake Chapala, Jalisco, and winters north to southern British Columbia. One specimen is recorded from the city of Vera Cruz, Mexico, where it was accidental.

Spring migration.—Records are insufficient to allow of exact statements in regard to the movements of the Hutchins goose. In general it can be said that it migrates later than *B. canadensis*. The average date of its arrival in northern North Dakota and southern Manitoba is April 12, fully two weeks later than the Canada goose arrives. Hudson Bay is reached early in May and the extreme northern part of the range not much before the first of June. The first was noted near the mouth of the Yukon River May 8 and on the Kowak River May 14. Eggs were taken near Fort Anderson, Mackenzie, June 10, 1864, and June 14, 1865.

Fall migration.—Small family parties begin to flock early in August and flocks appear at Aweme, Manitoba, on the average September 21 (earliest September 13, 1904). First arrivals were noted at Terry, Mont., September 22, 1904; Delavan, Wis., October 12, 1894; central Kansas, October 5–13; central California about the first of October. The last noted at Cape McDonnel, Great Bear Lake, was on September 25; at Fort Wrigley, Mackenzie, October 12, and on the Kowak River, Alaska, September 14.

Branta canadensis occidentalis (Baird). White-Cheeked Goose.

This form is confined to the Pacific slope and breeds from the Klamath Lakes and Lake Tahoe, north to Sitka and Mitkof Island. It winters from Washington south to San Diego County, Cal. It appears south of its breeding range in early November and starts north so early in the spring that after the middle of March few are left in the southern part of the winter range.

Branta canadensis minima Ridgw. Cackling Goose.

This form is confined during the breeding season to Alaska, where it breeds abundantly along the coast from the Kowak River to the north side of the Alaska Peninsula. It breeds very abundantly also on the western Aleutians. It winters in southern British Columbia and thence south to San Diego County, Cal. It has been known to wander east to Hudson Bay, Wisconsin, and Colorado.

It is the earliest goose to reach the mouth of the Yukon in spring migration, arriving there from the 25th to the 30th of April, a few days after the last have deserted the southern portion of the winter range. The return movement begins late in August, is at its height by the middle of September, and the first arrive in central California about the first of October. The species deserts the Yukon region the last of September or early in October, and the Aleutians about the middle of November.

Branta bernicla (Linn.). Brant.

This is the Old World species that breeds north of the mainland of Europe and extends west to the east coast of Greenland; winters in northern Europe, rarely south to the Mediterranean.

Branta bernicla glaucogastra (Brehm). White-bellied Brant.

Breeding range.—There is a lack of knowledge as to the dividing line between this form and the black brant (*B. nigricans*). It is known that the latter breeds on the Arctic coast of America east about to longitude 125° (Franklin Bay), and that the species reaches its summer home by migration from the west and southwest, and not from the south by way of the Mackenzie Valley. It is known that the eastern brant occurs in migration on Melville Peninsula and passes along the east coast of Boothia Peninsula, longitude 92°. There seems to be no record of brant on the Arctic coast of the mainland between Franklin Bay and Boothia Peninsula—nearly a thousand miles—and yet brant of some form are common on all the islands that lie between these two longitudes north of 74° latitude. It is practically certain that the brant swarming in Wellington Channel, directly north of Boothia Peninsula, are the eastern form. Brant were seen on September 7, 1850, at the south end of Banks Land, and as they were then in full tide of fall migration they were undoubtedly on their way to the Arctic coast of the mainland and belonged to the western form. A year later, August 19, 1851, "vast numbers" were seen in the northwestern part of the same island as they were gathering for their migration. These also, then, were probably the western form, and they bred commonly along the northern shore of this island. Melville Island is only 50 miles from Banks Land, and hence it is probable that the "brent geese" taken by Parry on this latter island were the black brant. The dates of migration are of no help in settling this question. Brant arrived on Melville Island June 6, 1820, before June 9, 1853, and were seen on the north coast of Banks Land soon after June 1, 1852, or at about the same date they arrived in 1882–3, at Point Barrow, considerably farther south. They were noted in the vicinity of Wellington Channel, about latitude 75°, June 3, 1851, June 2, 1853, and about June 9, 1854. Almost directly south the first were not noted on Boothia Peninsula, latitude 70°, until June 12, 1830; June 20, 1831; and June 8, 1859; and still farther south on Melville Peninsula not until June 14, 1822, and June 14, 1823. While on the west coast of Greenland, at latitude 72°, the first were seen May 29, 1850, and at the extreme northern limit of the range, above latitude 82°, near the northwestern part of Greenland, they arrived June 9, 1876; June 3, 1882; June 5, 1883.

The eastern brant breeds on the west coast of Greenland from Frederikshaab, latitude 62°, northward probably as far as land extends, certainly as far north as the north shore of Grinnell Land, latitude 82° 33′. It probably breeds also on the islands north of latitude 74° and west to Wellington Channel. Breeding records south of this district are unsatisfactory, though the species will probably be found to breed rarely on North Somerset Island.

Winter range.—It is common during the winter along the Atlantic coast from Florida to New Jersey, less common on Long Island, and rare during the winter in Rhode Island and Massachusetts. A straggler was secured on Barbados, November 15, 1876.

Records for the interior of North America are not numerous. Specimens are recorded from the Whitewater Valley, Indiana; Ottawa, Ontario, fall of 1887; Racine, Wis.; Omaha, Nebr., November 9, 1895; Lake Manitoba, spring of 1889; Fort Lyon, Colo., April 11, 1883; Comox, British Columbia, January 10, 1904.

Spring migration.—Since no brant in spring pass north along the west coast of Hudson Bay, all the individuals of the species must perform their spring migration on the Atlantic coast. They return in February to Long Island Sound, where they stay in mild winters, and appear on the southeastern coast of Massachusetts on the average February 23. They are common in these waters for six weeks. By the end of March the van has already reached northern Nova Scotia. They spend the next month around the Gulf of St. Lawrence, and then move slowly northward. All observers agree that the brant do not go around the east shore of Newfoundland, but steer more directly north across the Labrador Peninsula. The average date on which they reach latitude 46° in the Gulf of St. Lawrence is March 23, and it is not until May 30 that early arrivals have been recorded in latitude 79°, showing an average speed of 34 miles per day. The average date of arrival in latitude 82° is June 7, or an average speed from latitude 41° to latitude 82° of 28 miles per day. The most northern record of the brant is latitude 82° 33′ on the north coast of Grinnell Land. Here it arrived June 9, 1876, and the first eggs were found June 21. A hundred miles to the south, at Ross Inlet, eggs were taken June 16, and at Cape Sabine, latitude 78° 40′, June 17, 1900.

The last disappear from North Carolina waters the first week in April; most leave Cape Cod, Massachusetts, by April 24, and the remainder about the 1st of May, though at various times birds have been seen the last week of this month. The south shore of the Gulf of St. Lawrence is deserted usually June 9–12, just as the earliest brant are arriving on their breeding grounds.

Fall migration.—Southward-moving flocks of brant were seen August 20, 1876, at Cape Lieber, latitude 81° 30′, ten weeks after the first had passed north. In less than three weeks the last had disappeared, i. e., they were not over three months on the breeding grounds. The black brant breeding at Point Barrow, Alaska, were present from June 5 to September 20, 1898, fifteen weeks, and this latter period is about as long as the interval spent at their breeding grounds by those small land birds of the Gulf States that migrate earliest in the fall.

Brant reappear in the Gulf of St. Lawrence late in September, and arrive at Long Island about the middle of October. They occupy less than sixty days in retracing their flight over the course to cover which in spring requires more than one hundred days. In the fall migration great numbers pass south along the west shore of Hudson Bay, but as the species is almost unknown in Manitoba and Ontario, these birds must pass through northern Quebec to gain the Atlantic coast.

Branta nigricans (Lawr.). Black Brant.

Breeding range.—The principal known breeding ground of this species is along the Arctic coast and islands in the vicinity of the mouth of the Anderson River. Thence westward a smaller number breed at Point Barrow. The species is common on the Siberian coast of the Chukchi Peninsula and west to the New Siberian Islands. As stated under the preceding species, it is probable that the brant breeding abundantly on Banks Land and in smaller numbers on Melville Island belong to this species.

Winter range.—The main body of the black brant winters on the coast of California, especially at Bodega Bay and Tomales Bay. A few pass as far south as San Quentin Bay and Cerros Island, Lower California, and the species is known in winter north to the Straits of Juan de Fuca. It penetrates inland to Pyramid and Washoe lakes, Nevada; Malheur and Klamath lakes, Oregon, and on the Atlantic coast has straggled to Chatham, Mass.; Oneida Lake, New York; Islip and Great South Bay, Long Island, and Long Beach, New Jersey. On the Asiatic side the brant goes south in winter to Japan.

Spring migration.—Brant begin to move northward in early March, but proceed so slowly that it is the middle of May when they arrive at the mouth of the Yukon, and the last of May when they reach Kotzebue Sound; the dates of arrival at Point Barrow are June 13, 1882, June 7, 1883, and June 5, 1898; downy young were taken there July 10, 1898. Most of the birds have left the California coast by the last of April, and it is a little strange that one of the latest records south of Alaska should come from Lower California, where several brant were seen May 9 and 10 in San Quentin Bay.

Instead of taking the long course around the northwest coast of Alaska, some brant that nest near the mouth of the Mackenzie make a short cut across the interior of Alaska, and the species is abundant for a few days each spring at Fort Yukon and La Pierre House on its way north and is seen each spring at Fort McPherson passing north along Peel River.

Fall migration.—Migrants return to the mouth of the Yukon from the middle to the latter part of September, appear in British Columbia a month later, and reach the California coast in November. The latest dates for Point Barrow are September 21, 1882, and September 20, 1898.

Branta leucopsis (Bechst.). Barnacle Goose.

This species inhabits the northern parts of the Old World, and in migration reaches Greenland, where it has been taken repeatedly on the eastern coast around Scoresby Sound, and a few times on the western side at Julianshaab and Fiskernœs.

The barnacle goose has been taken several times in the United States, and though some of these birds may have escaped from captivity, it is not probable that all are escapes. The species is recorded as taken at Currituck Sound, North Carolina, October 31, 1870; near Jamaica Bay, Long Island, about October 20, 1876; North Chatham, Mass., November 1, 1885; Marshfield, Vt.; Montreal, Canada; Okak, Labrador; Racine, Wis., December, 1850; and one at James Bay, near Rupert House.

Philacte canagica (Sevast.). Emperor Goose.

Breeding range.—This is an Arctic species, with a very restricted range in the vicinity of Bering Sea. It breeds along the Alaskan coast from the mouth of the Kuskokwim River north to Cape Espenberg and the southern shore of Kotzebue Sound. The principal breeding ground is near the mouth of the Yukon River, but a few pass west to St. Lawrence Island and to the Asiatic coast, and breed on the Chukchi Peninsula in the vicinity of East Cape.

Winter range.—The Aleutian chain is the main winter home of the species, outside of which a few are found west to the Near and the Commander Islands and east to Bristol Bay and Sitka. Stragglers wander south and have been taken twice on Vancouver Island and three times in California—Eureka, winter of 1884; Gridley, November 1, 1895; San Francisco market, October 8, 1900. Four were taken and a dozen or more noted, evidently members of a straggling flock, December 12, 1902, in the Hawaiian Islands.

Spring migration.—At the extreme southwestern part of the range the northward movement begins late in March. The latter part of April the emperor goose moves from the southern to the northern shores of the Aleutian Islands and remains there for several weeks. As soon as the melting snows expose mud flats on the coast of Norton Sound the birds make the ocean flight to their breeding grounds, where they arrive from May 15 to 25. Eggs have been taken June 5, and young birds late in June.

Fall migration.—The geese regain their feathers after the summer molt about the middle of August, and a few at once start south. The earliest date on the Aleutians is August 31. Most of the species remain at the breeding grounds until October and then are forced slowly south by the approach of winter, scarcely reaching the southwestern limit of the usual winter range before early December.

Dendrocygna autumnalis (Linn.). Black-bellied Tree-duck.

This tree duck comes into the United States in the lower Rio Grande Valley and breeds as far north as Corpus Christi; it arrives in April, the bulk leave in September and the last in November. It ranges throughout most of Middle America from western Mexico (Mazatlan) to Panama (River Truando); accidental in Jamaica. It winters in Mexico at least as far north as central Vera Cruz (Vega del Casadero) and Mazatlan. North of this district it is strictly migratory, and throughout most, if not all, of its range in Central America there seems to be a shifting of location between the winter and the summer homes, but no data are available to determine the movements with accuracy.

Dendrocygna fulva (Gmel.). Fulvous Tree-duck.

Resident in southern Louisiana (Lake Catharine, The Rigolets, New Orleans) and from Mexico north to central Texas (Galveston, North Concho River), southern Arizona (Fort Whipple), central California, and west central Nevada (Lake Washoe). In California the species has been found breeding north to Los Banos in the San Joaquin Valley, has been taken in winter in the Sacramento Valley (Marysville), and has been noted probably as a straggler in Marin County (Inverness). The breeding range in Mexico is from Lake Chapala, Lake Cuitzeo, and the Valley of Mexico northward, while in winter the species passes south to Guerrero and Chiapas. It has occurred in Lower California.

An unusual case of wandering occurred in the fall of 1905. A flock of ten was seen at Grays Harbor, Washington, on October 3, and one was secured. A straggler was taken at Swan Island, North Carolina, in July, 1886.

The migration habits of the fulvous tree-duck are peculiar; one of the most northern records (Marysville, Cal.) is of a winter specimen, and almost the most southern (Lake Cuitzeo, Mexico) is of breeding birds. While the species as a whole moves north to breed and south to winter—these movements occurring in April and October—a few remain throughout the year in most of the range.

The same species is found in South America, where it breeds commonly in the vicinity of Buenos Aires, and occurs thence north through Uruguay and Rio Grande do Sul, Brazil, to central Paraguay (Asuncion) and northern Argentina (Tucuman, Fortin Donovan). Accidentals have been noted in central Chile (Paine), northern Peru (Moyobamba), northwestern Ecuador (Vinces), and east central Brazil (Port Capuno, Rio Belmonte). Questionable records appear from Venezuela and the Island of Trinidad.

The migration habits of the fulvous tree-duck in South America are the same as in North America; a few are resident at either extreme of the range, while the bulk move south to central Argentina to breed, and retire to northern Argentina to spend the colder portion of the year. The greater part of the species is, therefore, confined to the immediate vicinity of the Rio de La Plata and the lower valleys of its larger branches in a district approximately 700 miles in length north and south, and scarcely half that in width. This same species is found also in southern Africa and southern Asia.

[**Dendrocygna viduata** (Linn.). White-faced Tree-duck.

This species does not come north to the United States, but has occurred as a straggler in Cuba (three records) and in Barbados (one flock). Its regular range is from Central Colombia and northeastern South America to Peru, Bolivia, and Paraguay; less common in Argentina, south to Buenos Aires. It seems to perform no regular migration in any part of its range.

The same species, or one so closely allied that it has not yet been separated, inhabits much of Africa from ocean to ocean, and from about 15° north latitude (Senegal) to 27° south latitude (Potchefstroom); also the island of Madagascar. Its range in Africa, therefore, is more extensive than in South America, and on the whole is in about the same latitude, for the range in South America extends from latitude 11° N. to latitude 34° S.]

[**Dendrocygna arborea** (Linn.). Whistling Duck.

This duck is known only from the West Indies, where it ranges from Andros Island, Bahamas, through all the Greater Antilles to St. Croix, Virgin Gorda, and Barbados of the Lesser Antilles; said to be a migrant, but the available data do not suffice to trace its movements.]

[**Dendrocygna discolor** (Scl. & Salv.). Southern Red-billed Tree-duck.

This duck ranges north to the island of Trinidad and to Davila, Panama. It is of wide distribution in northern South America from Colombia to Guiana and south to eastern Peru and northern Brazil. It appears to be resident throughout its range, unless possibly in the extreme northern part, Trinidad, and Panama.]

DISTRIBUTION AND MIGRATION OF SWANS.

Olor cygnus (Linn.). Whooping Swan.

This swan is common in Europe and Asia, and formerly was not rare in Greenland, where it is now nearly exterminated. Single specimens of late years have been taken at Atangmik, Godthaab, Ivigtut, and Arsuk in southern Greenland.

Olor columbianus (Ord). Whistling Swan.

Breeding range.—The whistling swan breeds principally north of the Arctic Circle, but a few nest on Southampton and Nottingham islands in Hudson Bay, and the species is reported as breeding at Kennedy Lake in Baffin Land. It is fairly common during the breeding season along the Arctic coast in the vicinity of the mouth of the Mackenzie, and not rare throughout much of Alaska. A few pass to the islands of the Arctic Sea, even to latitude 74°. One of the parties of the

Biological Survey found the whistling swan breeding at Becharof Lake in southern Alaska, latitude 58°, this being the most southern breeding record. Thence it breeds along the Yukon, about Kotzebue Sound, and probably to Point Barrow. Though found on the Asiatic side at Bering Island, as yet there is no record of its breeding in that country. Accidental once in Scotland and once in the Bermudas.

Winter range.—Probably about as common on Chesapeake Bay during the winter as in any part of its winter home; many pass to the coast of North Carolina and a few to Florida. It winters regularly north to New Jersey, and during the winter of 1877–78, one remained on Nantucket Island, Massachusetts, in which State the species was common when the first settlers arrived, but is now so rare that it seems to have been recorded only four times in the last thirty years. It never was common in the interior of North America, but a few occur locally in winter from southern Indiana and Illinois to the Gulf coast of Louisiana and Texas. It is more common along the Pacific coast, and winters regularly from southern British Columbia to southern California (Ventura County), and probably one was seen at San Rafael, Lower California. The species is recorded as wintering on Near Island, Alaska, far north of the usual winter home. One was seen January 18, 1904, near Colonia Diaz, Chihuahua, and some years earlier one was killed in the winter at Silao, Guanajuato.

Syring migration.—The northward movement begins in March, as shown by the following dates of arrival: Erie, Pa., March 11, 1897; Williamsport, Pa., March 20, 1905; Deerfield, N. Y., March 13, 1890; Lockport, N. Y., March 20, 1886; Detroit, Mich., March 14, 1905; Delavan, Wis., April 1, 1895, March 31, 1896; Heron Lake, Minn., April 6, 1886, March 31, 1894; Elk River, Minn., April 8, 1886; Fort Collins, Colo., March 16, 1895; Jordan River, Utah, March 10, 1850; St. Michael, Alaska, April 27, 1878; Kowak River, Alaska, May 11, 1899; Fort Simpson, Mackenzie, May 5, 1904; Fort Anderson, Mackenzie, May 18, 1865, and Melville Island, May 31, 1820. One seen near St. John, New Brunswick, April 8, 1882, seems to be the only spring record on the Atlantic coast north of Long Island for the last fifty years.

Since the species breeds to the westward of Hudson Bay and winters commonly on Chesapeake Bay and yet is practically unknown in spring in northeastern North America, it follows that its route in spring migration trends to the northwestward, and it is evident why at this season the species is not uncommon in the region of the Great Lakes and Manitoba.

Most whistling swans leave the United States from the middle to the latter part of April; unusually late birds were seen near Baltimore May 4, 1905, at Williamsport, Pa., May 30, 1901, while nonbreeders have spent the summer on Lake Malheur, Oregon.

Eggs were found at Nulato, Alaska, May 21, somewhat later at the mouth of the Yukon, and about the 1st of June in northern Alaska. The last egg of a set found on Winter Island, Melville Peninsula, was laid June 9, 1822.

Fall migration.—A fine set of records of the arrival of this species in the fall at Alexandria, Va., gives November 6 as the average date for sixteen years, and the birds became common by November 22; the earliest date was October 15, 1901. Near Baltimore, Md., an unusually early bird was seen September 26, 1893. The northern part of Alaska is deserted in early September, and the southern part a month later; few individuals arrive at their winter quarters on the Pacific coast before November.

Olor buccinator (Rich.). Trumpeter Swan.

Breeding range.—The principal summer home of this swan is in the interior of North America from the western shore of Hudson Bay to the Rocky Mountains, and from about latitude 60° to the Arctic Ocean. In early times it probably bred south to Indiana, Wisconsin, Iowa, Nebraska, Montana, and Idaho; it nested in Iowa as late as 1871; in Idaho in 1877; in Minnesota in 1886, and in North Dakota probably for a few years later. It is not probable that at the present time the trumpeter nests anywhere in the United States, and even in Alberta no nests seem to have been found later than 1891. The vast wilderness of but a generation ago is now crossed by railroads and thickly dotted with farms. The species is supposed still to breed in the interior of British Columbia at about latitude 53°. The eggs have been taken at Fort Yukon, and this is the westernmost record of the species.

Winter range.—As the summer home of the trumpeter swan is in the interior, so also is the winter home. The species is not rare south to Texas and remains as far north as it can find open water, sometimes as far as southern Illinois and southern Indiana. During its migrations it occasionally strays to the Atlantic slope (Lincoln, Del., November 9, 1886; Cayuga Lake; Buffalo). Throughout the western mountains of the United States south to Colorado, it is hardly to be considered more than a rare straggler, but on the Pacific coast it is not uncommon in winter from southern British Columbia to southern California (Los Angeles County).

Spring migration.—Early writers on the movements of this species in the northern interior of Canada agree in considering it one of the earliest migrants, arriving before the geese and next after the bald eagle, which is the first spring bird in that region. It is reported to have been seen at Fort Carlton, latitude 52°, March 30. There are no United States records that corroborate this view; the first arrive in southern Iowa, on the average, March 19; at Heron Lake, Minn., the average date of arrival is April 4, earliest March 21, 1889 (a very early spring); other average dates are: Nebraska, March 16; South Dakota, April 2; North Dakota, April 15; Saskatchewan, April 16; British Columbia about April 20. All these dates are later than those which mark the arrival in these districts of the early ducks and geese.

Fall migration.—The trumpeter begins to move south early in September, crosses into the United States the last of that month, and reaches the Gulf of Mexico in Texas about the middle of November. The last remain on the breeding grounds until October, when they are forced away by the gathering ice.

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